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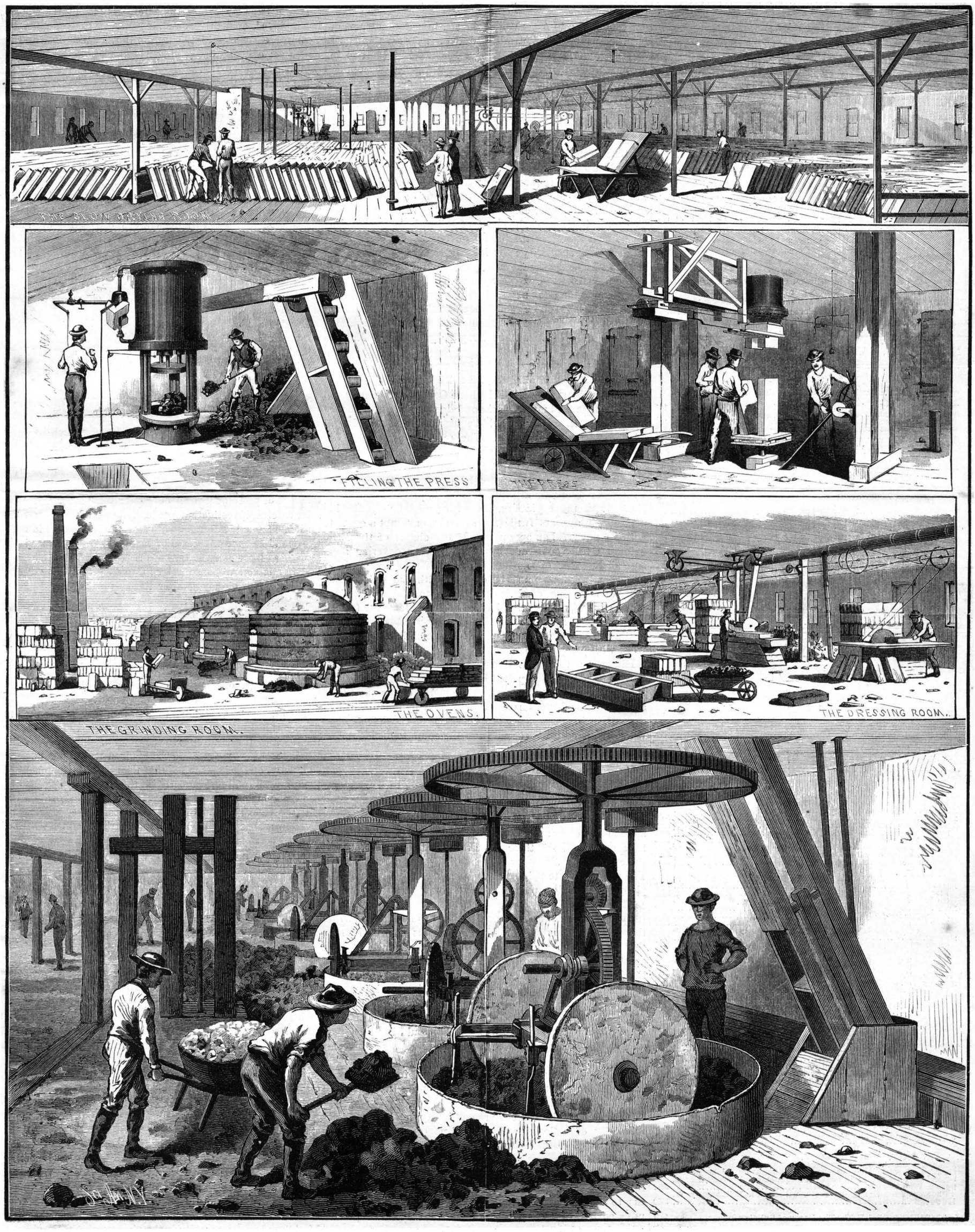


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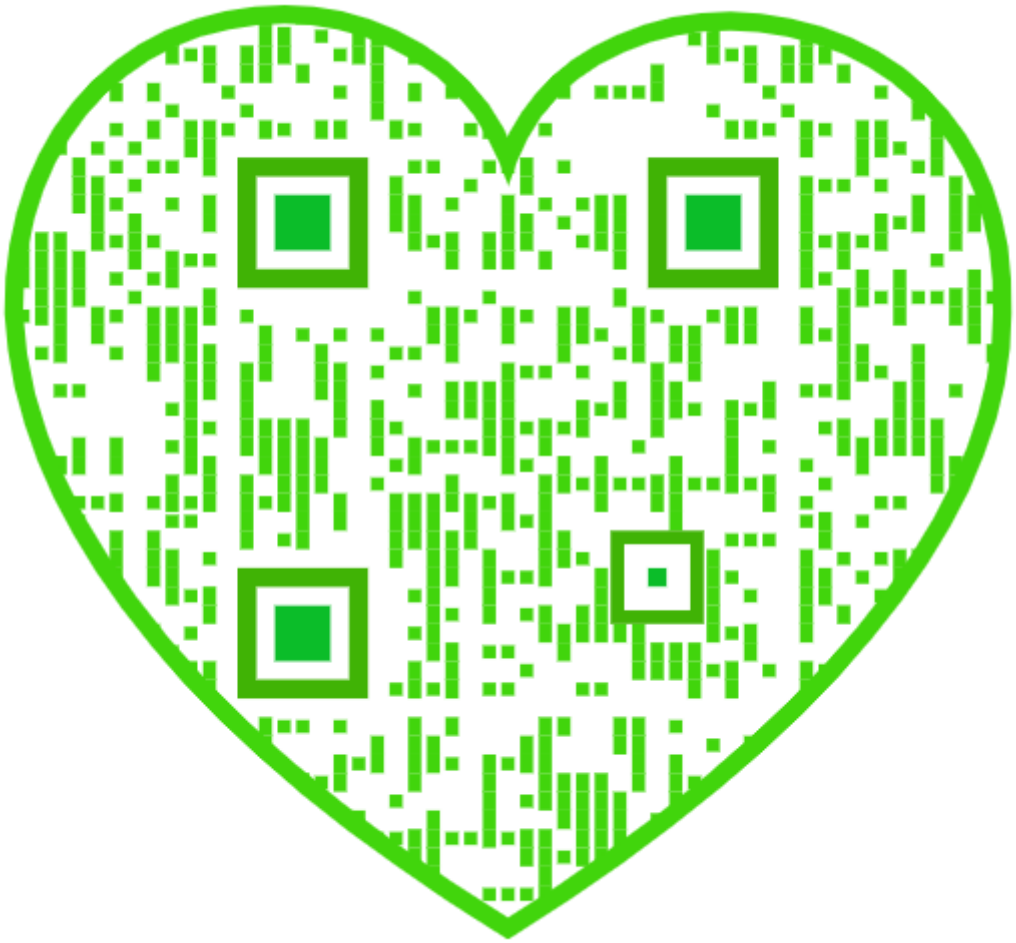

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NEW YORK, SATURDAY, FEBRUARY 17, 1883.


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## VIENNA INTERNATIONAL ELECTRIC EXHIBITION.

In the ten years since the Universal Exposition of 1873 was held in Vienna, the larger part of the modern advance in the utilization of electricity has taken place. Electrical science has entered upon a new phase, and from a very subordinate position among the great factors of the world's progress it has risen to a place very near the front.

Vienna, too, has undergone many and material changes. Though outstripped by Berlin, the city has grown rapidly, and has added much to its attractiveness to tourists by the erection of a large number of monumental public buildings and otherwise. The city has been surprisingly prompt in the adoption of electrical improvements and novelties in the way of telephones, electric lights, and the rest, and by its commanding position enjoys superior advantages as the commercial entrance to a large and populous portion of southeastern Europe.

Accordingly, to American engineers, inventors, owners of electrical patents, and manufacturers of electrical appliances and machinery, the International Electrical Exhibition in Vienna, to be held next fall, offers a very favorable opportunity for observation and study, and for presenting new electrical inventions and manufactures to a considerable portion of the civilized world.

A communication from Mr. Carl Pfaff, of the Managing Committee, dated Feb. 4, announces that the exhibition will continue from August 1 to October 31. No prizes or medals are to be awarded.

Among the more recent indications of electrical progress in that part of the world, our correspondent, Alfred Pollak de Rudin, in Vienna, mentions the lighting of the streets of Temesvar, in Hungary, by means of Edison lamps, to be completed next summer; the lighting of the Emperor's palace in Vienna by electricity; the introduction of telephones in the great general hospital of the same city, to enable patients in the infected wards to converse with their friends without risk of infection; the use of incandescent electric lamps in three of the large silk establishments of the city, the current being supplied by means of accumulators; and the lighting of the National Theater, in Prague, by means of Edison lamps.

## THE PROBLEM OF THE TELEPHONE.

That the American Bell Telephone Company is master of the telephone field must be acknowledged. Every telephone user knows it. Every would-be user knows it. Every telephone inventor knows it. The recent consolidation of telephone interests, the massing of capital, the successes in court, have made this company a tower of strength. With a capital of $10,000,000, swelled by premium to $18,000,000, with legal advisers, and experts schooled in the art of telephony from the beginning, and with judicial prejudice in its favor, it appears futile for a rival to attempt a contest with so powerful an opponent. If the claims of the Bell patent are to be construed by every court as covering any and all methods of transmitting speech electrically, then telephone inventors must be content with the bare possibility of disposing of their inventions to the controlling power; but if, on the other hand, the Bell patents are found to cover only a specific method and apparatus for transmitting speech, then there is a field in which inventors may work with prospects of a reward.

Hitherto, nothing has transpired in court by which the true status of the Bell patent has been defined, for in no instance has the court passed upon the merits of the questions at issue. The decrees have been obtained by default, or by consent, or in consequence of admissions of the defendants, which rendered it unnecessary for the court to decide upon the merits of the case.

It is held by some that the Bell patent covers only the method of and apparatus for transmitting speech electrically by means of undulatory currents of electricity. It is held by the Bell counsel and experts that there can be no other method, while it is claimed by others that another method and other apparatus may be employed to accomplish the same end. In all these phases of the telephone problem there arise questions for which there is now no answer. The most intricate points of law as well as the most subtile physical principles are involved; and now the question is, as to the advisability of pursuing telephone investigations for purely monetary considerations. Any one familiar with the present status of telephonic apparatus can readily see that there is no greater field for study, and none that has greater promise of profit in it, than that of telephone invention.

Let the legal aspect of the matter be as it may, it is positive that the accomplishment of certain improvements in the telephone would yield a far richer harvest than has been reaped by any inventor in this line. It should be no source of discouragement to the determined and intelligent inventor that hundreds, and probably thousands, have reached toward the prize with a grasp too short, for it is only a faithful index of the great value of the prize that so many have striven for it.

The results to be attained are continuity, uniformity, and reliability of action, increased volume of sound, freedom from external disturbances, increased distances, and better service for less money. How all this is to be accomplished we shall not attempt to suggest, but a few of the obvious things to be done are to reduce the delicacy of the apparatus, to increase the current used on the line wire and to use a current of lower potential, and to isolate the telephone wires from other line wires carrying heavy currents.

Why should not the telephone speak out in the ordinary conversational tone, and why should it not be spoken to in the same tone, without the necessity of being near the instrument? Why should not the distance over which conversation is carried on equal telegraph distances? Of course, we know that electricians and physicists have struggled with these problems, but what are the results?

If we are to have a long distance telephone, the induction coil must be discarded, because the secondary current avails itself of every avenue of escape from its conductor, and everything with which it comes into contact—the insulators, the air, even contiguous wires—rob it of some of its strength, so that in attempting to communicate by telephone over long lines the current is lost, little by little, at every insulator, and all along the line until it is finally insufficient to affect the receiver.

If a battery current of the strength used in telegraphy be employed, evidently something besides carbon must be used for electrodes in the transmitter, or the instrument under some conditions might yield an electric light instead of transmitting speech.

Some are of the opinion that speech can be transmitted by means of an interrupted current on a broken circuit. If this is possible, a proper apportionment of the periods of contact and periods of separation of the electrodes of the transmitter should give increased volume of sound, and permit of the use of a battery current on the line.

The fact that more than five hundred patents have been issued for telephonic improvements will naturally discourage inventors, but let the student of telephony consider that there is a great similarity between many of the telephone inventions; that the variations are mostly structural, and not in principle; that the majority of inventors are wedded to certain accepted theories; and finally, that most if not all of them are in the same groove, and that to obtain new results there must be a radical departure from the reigning idea; then he will look for means and methods differing from those of his predecessors.

In what the telephone of the future will consist we cannot predict; but it should be capable of talking and being talked to, as one person talks to another; and a man in New York should be able to transact business orally with another in Chicago or San Francisco.

## A FOUR-MILE DEPOSIT OF IRON ORE.

Public attention has just been brought to a deposit of carbonate of iron—siderite—extending a distance of four miles along the Hudson River, in Columbia County, and having a depth of eighteen feet. The control of this enormous body of potential wealth has recently been acquired by a combination of prominent iron and steel manufacturers, who after careful investigation are convinced that the new deposit contains a volume of ore equal to that of the famous Cleveland mine in the north of England, which now yields something like 6,000,000 tons of ore a year. The ore is similar in character, but superior in quality to the Cleveland ore. It is also closely similar to that of the great Luxembourg deposit in Belgium.

The geological and chemical features of the Columbia County deposit have been carefully studied by Prof. John C. Smock and Mr. Walter L. Lawrence, who, it is said, have demonstrated its volume and quality to be as above stated. They find that the ore contains 48 per cent of iron, 9¼ per cent of silica, one-half of one per cent of sulphur, and one-fortieth of one per cent of phosphorus.

The deposit is so situated that from every point the ore can be run to the water's edge by gravity, passing over the track of the Hudson River Railroad. The title to the whole tract is now vested in the Hudson River Ore and Iron Company, and it is promised that the active development of the property will begin early in the spring. Already the necessary machinery has been prepared for early shipment, and the construction of wharves, tramways, workmen's dwellings, etc., will begin as soon as the weather will permit.

The men who have invested so largely in this enterprise are among our wealthiest and most capable producers of iron and steel, and are not likely to be mistaken with respect to the value of the deposit they propose to develop. Accordingly, there is good reason to anticipate early changes in the iron and steel trade, which will make the United States entirely independent of foreign ores, and New York pre-eminently the iron State of the Union.

### Curious Effects of Lightning.

Some interesting effects of lightning have been observed by M. Alluard at the summit of the Puy de Dome, where, on a circular tower, is an iron mast about twenty feet high, supporting an anemometer of the Robinson type, with four copper cups. There is also a ladder and stand (both made largely of iron), to allow of access to the anemometer, for cleaning. Two metallic cables connect the system with copper plates in the ground. Under these conditions, St. Elmo's fire often appears at the salient points of the mast, stand, etc., and a slight hissing is sometimes heard. All the cups of the anemometer show numerous signs of fusion by lightning, and only in their upper half; their connecting iron circle has also been fused in some places. Wherever such fusion has occurred, the metal has been raised like a small volcanic cone in the center of a crater. Some exterior attractive force seems to have raised the melted substance. M. Alluard proposes to study the phenomenon more closely.

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### WHAT IS AN ARTIST?

In a recent lecture in this city, Dr. Seymour Haden, the eminent English etcher, gave a definition of art which is commendably more comprehensive than artists are apt to conceive. His view is so like that heretofore taken in this paper that we quote at length:

"An art and the principles of an art—what are they? The words are heard so often, they seem to come in at one ear and go out at the other. Yet I do not remember ever to have seen a definition of the word art which entirely satisfied me. The best way to arrive at a definition, perhaps, is to approach it, so to speak, from its negative side, and explain at least what art is not. Art is not manufacture. The French say *Arts et Metiers*, and we, Arts and Manufactures, using the words for the sake of the apposition. For all useful purposes the phrases are good; yet neither is correct. *Metier* means mastery, and may apply to art as well as to manufacture; manufacture means made by hand, and yet is constantly applied to works of the loom. Now, in what does art differ from manufacture? An art differs from a manufacture in this, that though it depends on material agents for its means of expression, yet those agents are of a simple kind, and are wholly directed by an impulse which has its seat and origin in the brain of the artist. Invest any of these simple agencies—the brush of the painter, the pencil of the designer, the needle of the etcher, the chisel of the sculptor, the knife of the surgeon, or the pen of the author, with any of the properties of the machine; render it in any way automatic, so as to place it in abeyance, and render unnecessary this brain impulse, and you will have as a result of their agency not an art, but a manufacture.

"A principle of an art, again, is that condition, or one of those conditions which by common consent are admitted to be necessary to its healthy existence, or, indeed, I may say, to its existence. Now, it follows that if this brain impulse is really at the bottom of art, the first principle of art is personality, originality, out of which come ideality, sensibility to external impressions, a sense of the beautiful, passion, poetry, and whatever else the mind of the artist is capable of. I do not say that all these attributes are necessary to the production of an ordinary artist; one may be a fair artist with one or two of them, and he must be a great genius who possesses them all. But one is absolutely essential—personality."

As far as he goes, Dr. Haden is right. But does he mean to limit the artist's agencies to the brush of the painter, the pencil of the designer, the chisel of the sculptor, the pen of the author, and the rest? We hardly think it. The tools of the goldsmith and of the silver (or white) smith have long since been admitted among the agencies of genuine art work. When the silversmith, having a noble purpose, puts himself—his personality, thought, feeling—in sufficient measure into his work, his art is justly called fine art. This being admitted of the whitesmith, who can deny it of the blacksmith? The fact that the blacksmith's aim is utility oftener than mere ornament only strengthens his position in the art world if his personality is fine and noble and is well expressed in the thing of iron his skillfully-wielded hammer has wrought out. All genuine art development has blossomed out of and around pure utilities. The right of the potter, the wood-worker, the weaver, and all other masterful workers (who put themselves into their work, and have in themselves something worth putting into work) to be ranked among artists depends upon themselves, and what they do, not upon the material they work upon or the tools they use.

On the other hand, many an æsthetic marble-cutter or brush-wielder, who thinks himself an artist in the highest sense because true painters and sculptors are, is after all no artist. His "art-work" is make-believe. It is mimicry, not the expression of creative brain-power, and not to be compared with the purposeful work of many whom he would call mere mechanics and manufacturers.

### THE STAR OF BETHLEHEM.

The reappearance of the variable star poetically known as the Star of Bethlehem is among the possibilities of the present year; for unless astronomical calculations are in fault, this long-looked for star must flash forth from the sky-depths before the year 1885 has completed its course, and it may appear at any time, as its period, if it have one, is very near completion.

In the year 1572, Tycho Brahe, a Dutch astronomer, discovered a new star near Caph, in the constellation Cassiopea. It was of the first magnitude when first seen, increased rapidly in brilliancy, outshining Sirius, and soon equaling Venus, and was easily detected at noon-day by good observers. The color of the great star was at first of a dazzling white, then it changed to yellow, and finally became red. It shone brightly for nearly a month, then gradually faded, and in sixteen months disappeared from view.

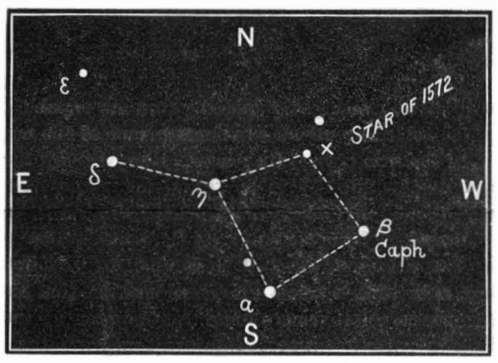
There were at the time a variety of opinions concerning the cause of this remarkable phenomenon. Some observers looked upon it as a fresh creation, a new comer in the universe. Other observers, and the larger portion, considered it as a sun on fire, a grand celestial conflagration, symbolizing the fate sure to overtake our sun and his retinue of worlds when the end of all things arrives. Astronomers were content with various speculations on the subject without coming to any definite conclusion, though it was the general opinion that the bright star in Cassiopea had fulfilled its mission, and would never again shine in the star-depths. A few stars with a similar history had been observed at long intervals, and these, as well as the brilliant new-comer, were included in a class known as new or temporary stars.

Forty years after the occurrence of this event, the telescope was invented. When it was turned to the position in the heavens occupied by the blazing star, a telescopic star was found within a minute of the identical spot which had been carefully mapped out by Tycho Brahe. This telescopic star is still found there, and is probably the same star that suddenly flamed forth in 1572.

The discovery that the famous star had not ceased to exist stimulated investigation. Astronomical annals were diligently searched, and it was found that similar bright stars were recorded as appearing in the same region of the sky in the years 945 and 1264. It is therefore inferred that the great new star of 1572 is a variable, with a period of a few more than three hundred years. If this theory prove true, we may soon hope to witness a repetition of this incomprehensible phenomenon. The last period was three hundred and eight years. The star was therefore due in 1880, and, if it appear at all, must dazzle our admiring eyes in the immediate future. By counting back three periods from the star's first recorded appearance in 945, we are brought to the near vicinity of the birth of Christ. Observers gifted with poetic fancies have not failed to connect the two events, and to infer that the Star in the East pointing to the place of the Nativity was the sudden outburst of this extraordinary star. Hence it has received the name of the Star of Bethlehem.

About twenty-four temporary stars have appeared from time to time in the last two thousand years. It is nearly certain that they all existed in the skies as very small stars before they blazed forth, and that, though apparently blotted out, they still exist there, ready to blaze forth again when the same conditions induce another conflagration. They are now classified as variable stars, though their long periods are of an incomprehensible and irregular character.

Thus there are variable stars of many varieties, from a well-behaved variable like Algol, that completes its regular changes in a period a little less than three days, to an erratic variable like the star in Cassiopea, that appears with a sudden outburst and then remains quiescent for centuries. In the case of the regular variables, it is easy to account for




the maximum and minimum light by the interposition of dark satellites, hiding a portion of the light as they pass between us and the star, or by the theory of sun spots, lessening at times the light of the star. Our sun is a variable star, and viewed from the nearest of the neighboring orbs probably shines as a yellow star of the third or fourth magnitude with a period of about eleven years, identical with the sun spot cycle. In the case of fitful variables, there is reason to believe that the sudden flames are due to outbursts of glowing hydrogen, resembling those of which the rosy protuberances around our sun give an illustration on a small scale.

If these outbursts are caused by eruptions of burning hydrogen, and if the protuberances around the sun are due to the same agent, the question naturally arises whether there may not be danger of similar outbursts from the solar surface. Such a catastrophe would doubtless involve the destruction of at least the higher forms of animal and vegetable life. Such a possibility exists, but the probability is too small to excite a moment's alarm. Only twenty-four blazing suns have been observed in two thousand years, while millions of stars have shone in the heavens, with a constant and serene light that has remained unchanged since men began to study these twinkling mysteries. The chances that the sun will blaze forth in the erratic style of the star of 1572, are therefore not more than one in a million, no greater than the probability that a huge comet will plunge headlong into the sun, or come into collision with the earth.

Observers will do well to keep an eye upon the constellation Cassiopea. Unscientific observers are as likely to be the first to detect the presence of the brightly beaming orb as those who possess special training for the work. If the long lost Star of Bethlehem return to its old position in the sky, it must return speedily, for every day increases the nearness of the advent. The year 1883 may, therefore, be made illustrious by a celestial visitor with a dozen comets, an event that would be almost as welcome to astronomers as the discovery of the cause of sun spots, or the accurate determination of the sun's distance.

Cassiopea is a constellation excellently situated for observation. It is on the opposite side of the pole from the Great Dipper, and at nearly the same distance. A line drawn through Megrim, one of the stars in the square of the Dipper, continued to the Polar Star, and extended to an equal distance beyond, will reach Caph, a star of the third magnitude in Cassiopea. This star with three others of about the same magnitude and a smaller one form the figure of an inverted chair. As in this latitude the constellation is always above the horizon, it can be seen at all hours of the night.

The diagram shows the principal stars of Cassiopea, and gives the relative position of those that form the chair. The point where the star of 1572 appeared is marked with a cross. Its right ascension is 0 h. 19 m., and its declination is 63° 24′ north. It is about 5° north northeast of Caph or Beta Cassiopeæ.

### THE PAST YEAR IN THE PATENT OFFICE.

The annual report of the Commissioner of Patents for the year ending Dec. 31, 1882, shows that the balance in the Treasury on account of the Patent Fund was increased during the year from $1,880,119.32 to $2,205,471.10. The business done was largely in excess of that of the previous year and more than double that of 1866, as shown by the fees received and the number of patents issued, evidence enough of the rapid development of the service.

The total number of applications relating to patents was 31,522; of these 30,270 were for inventions, 948 for designs, and 304 for reissues. The number of caveats filed was 2,553; applications for registration of trade marks, 796; labels, 532; disclaimers filed, 20; appeals, 691; making in all 367,114 occasions for investigation and action. The number of patents granted and certificates issued was 20,518. Six thousand and ninety-nine patents expired during the year, and 1,791 were withheld for non-payment of final fee.

New York led in the number of patents received (3,779), and was followed at a long distance by Pennsylvania and Massachusetts, close together (1,843 and 1,815), and by Ohio and Illinois, also close together (1,466, and 1,422). New Jersey took out 835 patents, Connecticut 794, Michigan 637, Indiana 613, California 486, and Missouri 485. Wisconsin took 356, Iowa 348, Rhode Island 382, Maryland 372, and the rest smaller numbers. New Mexico took 8, the Army and Arizona 7 each, Idaho and Wyoming 4 each, and the Indian Territory brings up the rear with 3. Connecticut led in the ratio of patents to population (1 to 782), and was closely followed by Rhode Island (1 to 980) and Massachusetts (1 to 982). Excluding the District of Columbia, which is not representative, New York, ranks next with one patent to 1,345 people, and New Jersey next with 1 to 1,354.

Eleven hundred and thirty-five patents were issued to foreign inventors, England taking the lion's share, 399; Canada took 228, Germany 219, and France 129. Switzerland is credited with 35, Austria with 32, Italy with 20, Belgium with 11, Denmark, Sweden, and Russia with 10 each. The remaining few were widely scattered.

The Commissoner renews the annual appeal for more help, more room, and more money—needs which are plainly obvious everywhere except in Congress. The urgent necessity of carrying on the suspended work of making a classified abridgment of patents already issued is again insisted upon. In view of the fact that accumulated funds of the Office already exceed two million dollars, there can be no reasonable excuse for depriving the Office and the inventive public of the benefits of the much needed digest.

### Improved Accumulating Batteries.

A great improvement has, it is said, been effected in accumulators by a combination of the Faure-Sellon-Volckmar patents. The Pullman train on the Brighton line, which formerly was lit by 18 incandescent lamps, supplied by 70 Faure accumulators, is now illuminated with 40 incandescent lamps, the current for which is supplied by 30 Faure-Sellon-Volckmar accumulators, the total weight of which is less than half those formerly employed.

According to Prof. Ayrton, the old accumulators weighed 130 pounds in working order, and gave a current equivalent to one horse power for three-quarters of an hour; whereas the new pattern weighs only about 75 pounds, and gives a horse power for an hour. The flannel or felt is now dispensed with, and the plates are so arranged now that a defective or imperfect one can be easily removed.

### A New Fish and New Insects.

Several animals, new to science, were lately described to the Paris Academy. One is a strange fish brought up from a great depth off the Morocco coast; it is about a foot and a half long, and of deep black color; but its most striking feature is its very large and capacious mouth with elastic membranes, much resembling a pelican's. Probably, food is partly digested in this cavity. The fish (which M. Vaillant calls *Eurypharynx pelecanoides*) has very little power of locomotion. M. Brongniart described a new fossil insect of the order of Orthoptera from the coal formation of Commentry (Allier). Insects are rare in the Carboniferous strata; hitherto only 110 specimens have been obtained in the whole world. That now found is of remarkable size—about ten inches long, and the family of Phasmidæ, or "walking-stick insects," is that which comes nearest to it. M. Brongniart names it *Titanophasma fayoli* (M. Fayol sent it). The upper part of the thorax not being preserved, it is impossible to say whether the insect was winged. Once more, M. De Merejkowsky described a new class of infusoria, called Suctociliates, and forming a sort of connecting link between ciliates, which are characterized by small vibratory hairs, and acinetians, which have no such hairs, but have *suckers*.

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## AN AMMONIA STILL FOR SMALL GAS WORKS.

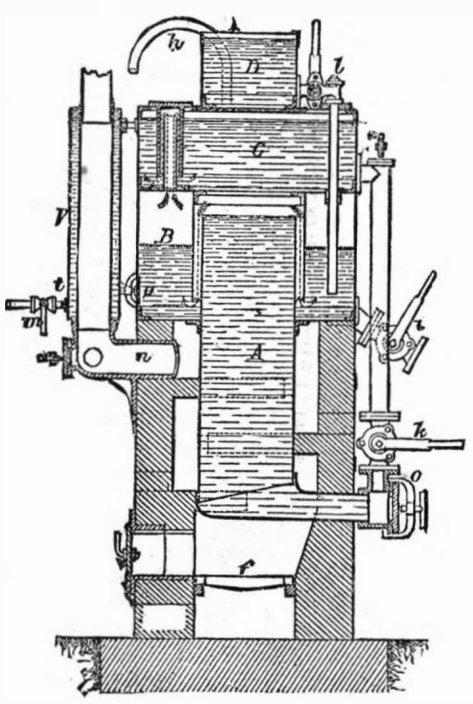
The accompanying illustration represents an apparatus designed by Herr J. Gareis for the distillation of ammonia from the ordinary ammoniacal liquor of gas manufacture, and is taken from the *Journal fur Gasbeleuchtung*. The arrangement is intended for small gas works, being compendious in design, cheaply constructed, simple and economical in working, and reliable. The smallest example, for treating one cubic meter, or 220 gallons of liquor per 24 hours—a class of apparatus that has a long time been in regular use—produces 40 kilos of sulphate per cubic meter of liquor of 2·25° Baume, with an expenditure of 30 kilos of acid, 4 kilos of lime, and about 50 kilos of coke for fuel. A larger apparatus for 2 cubic meters, or 440 gallons of liquor daily, gave 5,547 pounds German (5,714 pounds English) of sulphate from 59·280 cubic meters (13,042 gallons) of liquor of 2° Baume.

The principle of the arrangement is clearly shown in the drawing. The boiler comprises four distinct parts, A, B, C, and D, of which A and C contain the pure liquor to be distilled. The section, B, contains liquor with the addition of milk of lime, for setting free the fixed ammonia. D is the lime box.

The division, A, is heated directly by fire in the furnace, *f*, whence the smoke as well as hot gases escape through the chimney, *n*. The steam and ammonia developed from the liquor in A, pass together in the direction shown, to the bottom of the division, B, where they meet with the liquor mixed with lime. A constant boiling is maintained in this compartment, whereby the heavy particles of lime are prevented from settling to the bottom. The steam and gases from B escape through the pipe as shown, and find their way to the bottom of the division, C. In this a partial condensation of the steam takes place, with consequent heating of the liquor; while the incondensable ammonia escapes through the pipe, *h*, for conversion either into liquor ammoniæ or sulphate.

When, through long continued boiling, all ammonia has been driven off from the contents of B, the cock, *i*, is opened, and the vessel is thereby emptied. The cock, *k*, is then opened, and the liquor from C is admitted to the lower part of the division, A, while the liquor previously contained in this division overflows into B, until the working level is reached. This cock may then be closed, and the required quantity of milk of lime run into B by opening the cock, *l*, communicating with the lime tank, D; the necessary proportion being found by experience. The division, C, must now be filled with fresh liquor from the store tank, and the operation then goes on as before. The change of liquor herein described is made about every four hours, when the apparatus is in regular working. The drawing shows how the fresh liquor, before being admitted to the division, C, may be warmed by passing through an annular jacket, V, surrounding the furnace chimney; the supply of cold liquor being taken into the bottom of this jacket through the pipe, *t*, fitted with the cock, *m*.

The necessary cleansing of the boiler, A, is provided for by the movable cover, *o*, secured merely by a crossbar and screw. The section, B, is cleaned when required through the manhole, *p*. The compartment, C, may be cleaned by removing the small lime tank, D. It is not necessary that this tank should always be fixed on the top of the still itself, since any other elevated position will serve, so long as the

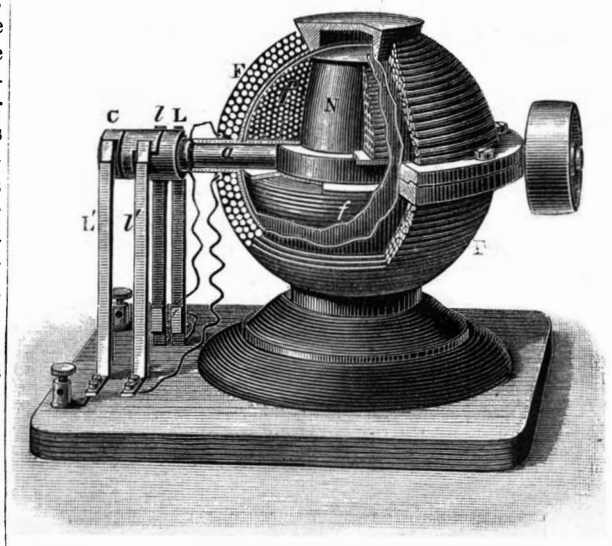


IMPROVED AMMONIA STILL.

contents will run into the division, B. Neither is direct heating, by means of a furnace as shown, essential to the proper working of this arrangement. All that is necessary for the successful use of the apparatus is that the raw liquor shall be stored so that it will run into the vessel, C, and that the lime tank is charged with a sufficiency of liquid. Any kind of saturation tank or fishing box may, of course, be used to receive the evolved ammonia. The cost of the apparatus as illustrated, in Germany, for 1 cubic meter of liquor per 24 hours, is about £75; for 2 cubic meters of liquor, about £115; and for 3 cubic meters, about £150. The arrangement appears to be particularly neat and simple, and to be well adapted for the class of establishments mentioned by the designer. Although nothing is said about constant working in the original description, it would appear upon inspection of the drawing, that at least a regular flow of liquor might be permitted, even if the admission of milk of lime were intermittent. The small space occupied by the still is not the least advantageous of the several peculiarities which it presents; although this very compactness may form a ground of objection to many engineers. It must be remembered, however, that the design is not put forward as a plan for treating liquor on a large scale, but is intended to meet the case of small establishments where the ammonia has not hitherto been recovered on the premises.—*Journal of Gas Lighting.*

## ELECTRIC MOTORS WITH INDUCTORS CONTAINING NO IRON.

It is at present demonstrated that the best electric motors are those machines that are based upon the principle of the Pacinotti ring. In these apparatus, in fact, the attraction of the magnetic field on the armature is exerted continuously




BURGIN'S SPHERICAL MOTOR.

and without any changes of polarity that are capable of giving rise to retarding effects as a consequence of the magnetic inertia of the iron core. By reason, however, of the high price of ring machines, it is as yet advantageous, for small powers, to make use of motors in which there is a reversal in the direction of the current. In the construction of motors on this principle, the fact (indicated for the first time by Deprez in 1878) is taken into consideration that the iron cores of the movable parts should be reduced as much as possible, in order to suppress in a great measure the prejudicial effects due to the slow magnetization and demagnetization of the iron; and, in the majority of the present motors, there is employed as a movable armature Siemens' double T iron bobbin, which was pointed out by Deprez as very well realizing the conditions just mentioned.

With this system we diminish in a great measure the effects due to the magnetic inertia of iron; but we do not eliminate them completely, and the idea of entirely suppressing such prejudicial actions has given rise to a series of apparatus all based upon the same principle, and which the motor recently constructed by Mr. P. Jablochkoff gives us an occasion to pass in review.

In order to avoid remanent magnetism, Mr. Dering, about thirty years ago, devised an apparatus called the *Galvanometric Motor*. This consisted of a certain number of galvanometric helices, all of the magnetized bars of which reacted upon the same axis, and reversals of the current occurring at every half revolution of the bars, in the wire of the inducting helices. The motor contained no piece of soft iron capable of intervening through its remanent magnetism.

In 1879 Mr. Deprez constructed, with the same end in view, a machine of which some idea may be had by imagining one of his motors in which the permanent magnet was replaced by a flat rectangular galvanometric helix, so constructed as to embrace as perfectly as possible the curve of the bobbin. The changes of direction in the current took place in the galvanometric helix, and, the poles of the bobbin always remaining of the same name, there were no longer any contrary actions due to remanent magnetism. This apparatus gave so poor results that its inventor did not deem it worth while to publish a description.

In 1881, Mr. Burgin exhibited at the Palace of Industry an apparatus called the *Spherical Motor*, based upon the same idea. The field magnet consisted of a spherical shell, around which were rolled horizontally the copper wires, F F.

In the interior of the hollow sphere there revolved around an axis, A, a spherical electro-magnet having for core the mass of iron, N. The flat springs, L L', bore against the solid parts of the commutator in such a way as to send into the wire, *f*, a current always of the same direction; but the springs, *l l'*, through which the current entered the wire, F, rested against the cleft middle part of the commutator, so that at every half revolution the current changed direction in the wire, F. Motion was thus produced by the action of the magnet, N, upon the wire, F, in the same manner as in other motors; but the reversal of the current was effected in a part that contained no iron, and the effects due to the magnetic inertia of that metal were suppressed as in the preceding apparatus.

Finally, very recently, Mr. Jablochkoff has devised a new motor, which he calls the *Ecliptic*. The movable part is formed of a flat bobbin, *b* which is placed obliquely on the axis of rotation. This bobbin is of iron, and the whole thus forms a short electro-magnet. The fixed part is a larger bobbin, B, with a copper frame, arranged obliquely to the axis like the other, but in an opposite direction. The arrangement of the commutator is such that the current always traverses the movable bobbin in the same direction, and that the changes of directions, at every half revolution, take place only in the fixed solenoid. The actions that are exerted between this solenoid and the armature cause a rotation of the latter.

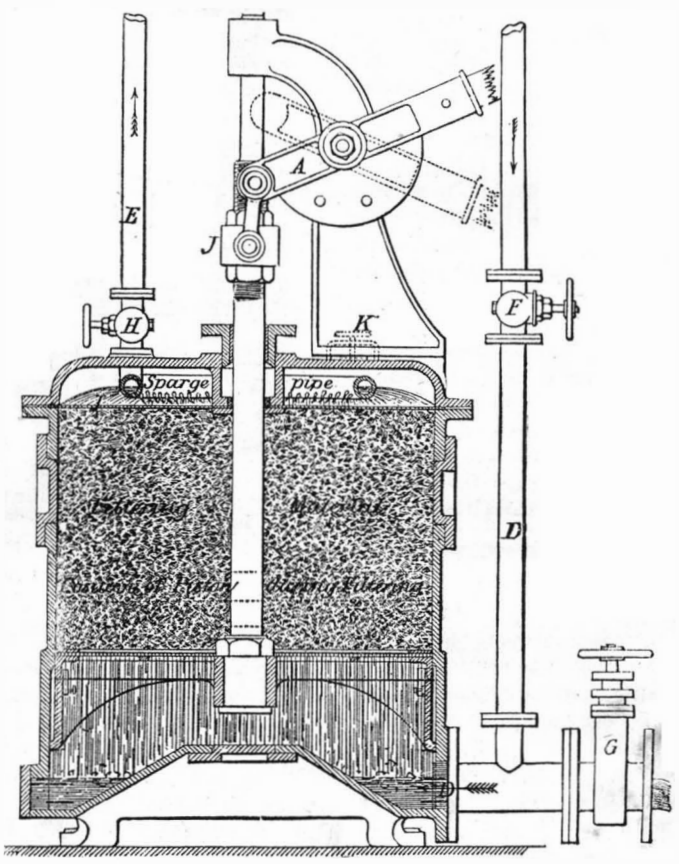
It will be seen that although Mr. Jablochkoff's bobbin differs from those just described in the peculiar and original arrangement of its bobbins, it likewise utilizes the idea of producing changes in the direction of the current in a part containing no iron.

All these apparatus, then, suppress the inconveniences resulting from the magnetic inertia of this metal; but this is no reason why they should be considered an improvement over systems employing iron cores of small dimensions. Although the prejudicial action of iron is, in effect, suppressed, there still remains that of the extra currents produced by the influence of the wire spirals upon each other; and these extra currents inevitably produce a notable contrary effect. Besides, although the iron is no longer there to intervene as a disturbing force, it, on the other hand, no longer lends the solenoid its re-enforcing action, so that what is gained in one direction is lost in another.

It goes without saying that all the apparatus described above are reversible, and may be regarded not only as motors but also as dynamo electric machines. But they evidently present no more advantages from such a point of view, and the fact is, they should be considered, not as practical apparatus, but as interesting arrangements that ingeniously utilize electro dynamic actions.—*La Lumiere Electrique.*

## IMPROVED SPONGE FILTERS.

The problem of constructing a filter for steam users and manufacturers that should be able to deal with large quantities of muddy river and canal water, and should at the same time be capable of being easily and efficiently cleaned, has been solved, says *Engineering*, by the Pulsometer Engineering Company, of the Nine Elms Iron Works, by the adoption of an elastic filtering material, which when compressed forms a compact bed through which the water percolates,




IMPROVED SPONGE FILTERS.

but when released immediately expands, freeing itself from the accumulated dirt, and offering little resistance to the flushing current that is then sent through it in the opposite direction. The material employed is sponge contained in a cylinder, and normally compressed between the cylinder end and a piston. While the cleansing operation is being conducted, the piston is alternately raised and lowered, the action on the filtering medium being similar to that ordinarily

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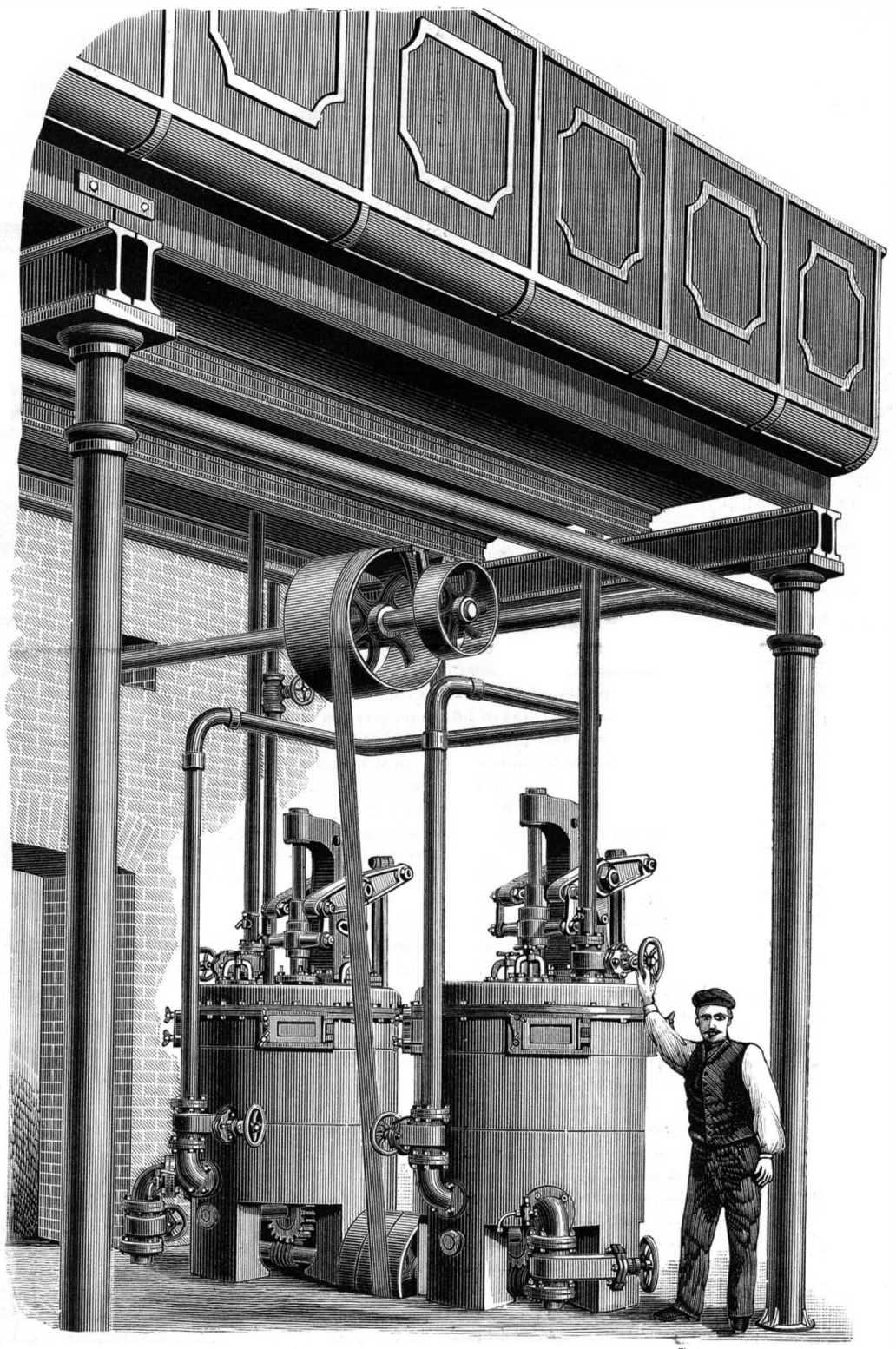
adopted in washing a soapy sponge; it is first allowed to absorb water until the pores are filled, and then the water is squeezed out, carrying a part of the mud with it, the process being continued until the effluent water is clear.

A very successful installation of these filters is now in operation at the works of Messrs. Garton, Hill & Company, saccharum manufacturers, Battersea, London, where it is supplying feed water for eight boilers, each 30 feet by 7 feet. Two filters of the largest size are employed, and when the five remaining boilers that will be required when the works are complete have been put down, will run night and day. At the present time, when the river is particularly muddy, the effluent water from the filter is bright and clear, and as far as appearance goes, is similar to the company's water, which is also drawn from the Thames, though of course at at a higher part of the river, and has been submitted to an elaborate process of settling, and filtration by sand beds. The immense quantity of mud eliminated by the filter is made manifest as soon as the cleaning process is commenced, when it pours out in a thick stream, gradually becoming clearer and clearer until the turbidity ceases. It is not contended that sponge has any power to extract the soluble impurities contained in water, or to counteract the ill effects of contamination by sewage. All that is claimed for the filter is that it will rapidly cleanse large quantities of muddy water sufficiently for every manufacturing purpose and for feeding boilers both on shore and in river boats, and that with a very small amount of care it will remain in good working order for years. Large numbers of these filters have been delivered both at home and abroad, one firm having already ordered nine for use on river steamers in Demerara. These filters are made in five sizes, the smallest of which will pass from 100 to 150 gallons per hour, and the largest 2,000 to 3,800 gallons.

The construction of the filter is clearly shown by the illustrations, one being a vertical central section, showing the parts as they appear while the filter is being cleaned, and the other a perspective view of the double installation at the saccharum works. The apparatus consists of a cast iron copper lined cylinder fitted with a piston, formed of a circular grating covered with wire gauze. The filtering medium is contained between this piston and a perforated plate, I, which forms the face of a collecting chamber constructed in the cylinder cover. The piston rod is coated with gun metal, and passes through a stuffing box to a guide fixed on the cover. Between the gland and the guide it is provided with a crosshead, J whose position can be adjusted by means of a screw thread on the rod. This crosshead is connected by two links to a double lever, A, by which the piston can be raised and lowered in cleansing the sponge. The agency for operating the lever varies according to circumstances and the size of the filter. In the annexed section a hand lever is shown, while in the installation at Messrs. Garton, Hill & Company's works a connecting rod couples the lever to a crank disk driven by a worm and worm wheel and fast and loose pulleys. In some cases it is more convenient to dispense with the lever and to employ a steam cylinder mounted upon the guide bracket after the manner of a steam hammer cylinder. In order that there may be no liability of the apparatus to set fast, even it be neglected, the metallic contact between the piston and the cylinder is made as narrow as possible, and wooden guiding strips are fitted to the outer ends of the strengthening ribs. The water to be cleansed enters at the lower part of the filter at D, and rising through the piston and the compressed layer of sponge, escapes by a pipe, E, from the chamber formed in the cover, to the tank where it is to be stored, the propelling force being preferably the action of gravity. When the filter is to be cleaned, the supply of dirty water is cut off by closing the valve, F; the mud cock, G, and air inlet, K, are opened, and a portion of the filtered water allowed to flow back to waste, while at the same time the piston is slowly raised and lowered.



IMPROVED SPONGE FILTERS FOR BOILERS.

A FISH of solid gold, of the bullion value of $2,500, is reported to have been dug up in Ober-Lausitz, the border land between Saxony and Silesia. Its surface is said to be incised with mythological figures, wrought after archaic Greek patterns.

### How to Split a Sheet of Paper.

Many people who have not seen this done might think it impossible; yet it is not only possible, but extremely easy, as was explained in this paper, several years ago, and recently described in the *British and Colonial Printer and Stationer*, which is as follows: Get a piece of plate glass, and place on it a sheet of paper; then let the latter be thoroughly soaked. With care and a little dexterity the sheet can be split by the top surface being removed. But the best plan is to paste a piece of cloth or strong paper to each side of the sheet to be split. When dry, violently and without hesitation pull the two pieces asunder, when part of the sheet will be found to have adhered to one and part to the other. Soften the paste in water, and the pieces can be easily removed from the cloth. The process is generally demonstrated as a matter of curiosity, yet it can be utilized in various ways. If we want to paste in a scrap book a newspaper article printed on both sides of the paper, and possess only one copy, it is very convenient to know how to detach the one side from the other. The paper when split, as may be imagined, is more transparent than it was before being subjected to the operation, and the printing ink is somewhat duller; otherwise the two pieces present the appearance of the original, if again brought together. Some time ago, the *Stationer* says, the information of how to do this splitting was advertised to be sold for a considerable sum.

### Improvements in Wrought Iron Tubes.

Some improvements in the manufacture of covered wrought iron tubes have recently been made, intended to remove some objections hitherto urged against this kind of pipe, especially when used for hot gases or laid in a damp situation. The inventor, a Mr. Rhodes, proposes to take sheets of asbestos paper or cloth, prepared with a suitable glutinous size. The material is then coiled upon a mandrel, and when set it is removed therefrom; being fit for use as a fireproof lining for metal tubes, or for covering the same, when they are used for ventilating-pipes for gas-burners. Tubes of similar construction are also recommended for chemical works, because of their power of withstanding the action of corrosive vapors and liquids. For outlet tubes of ventilating gas pendants the asbestos layers may be laid of sufficient strength without any metallic covering or lining. Another method of making wrought iron pipes, recently introduced, consists in laying on a mandrel alternate volutes of sheet iron strips and hot asphaltum. The iron is laid in contrary folds, one over the other, and simply bonded together with asphaltum. For 4-inch and 6-inch pipes there are two layers of sheet iron, and more for large tubes, according to diameter and the strength required. The ends of the tubes are finished off with cast iron rings coated with asphaltum, forming a straight butt joint readily covered with a welded iron sleeve, lined with lead at the works, and only requiring to be placed in position and set up when laid. Repeated tests of this form of pipe show that it possesses a bursting strength corresponding so exactly with the tensile strength of the sheet iron employed that the latter may safely be taken as a guide, and the pipe made of any desired strength by increasing the thickness of iron to the required extent. Bends or branches for use with this description of spiral pipe are made of cast iron asphalted. The absence of brazed or riveted joints in the length of this pipe is claimed to be a valuable characteristic.

### Petroleum in 1882, and the Outlook.

The last year has been altogether the most extraordinary one in the history of the oil business. It has exhibited, among other things, these peculiar phases:

1. The largest volume of daily production. 2. The most sudden development of the richest pool ever discovered. 3. The largest and most sudden decline in daily production ever known.

We began the year with a daily production of about 76,000 barrels. By the opening of the Cherry Grove field, we increased this daily output in the month of July to 105,000 barrels, the largest daily production ever reached. In the month of July the Cherry Grove field yielded about 30,000 barrels daily; it then became defined and reached its height. From this time it began to decline, first moderately, then rapidly until the close of the year, when its daily yield was less than 4,000 barrels. The general decline in daily yield, chiefly caused by the decline in Cherry Grove, has continued, until at the end of the year it reached 61,210 barrels.

The average daily production for the year was 82,000 barrels, so it will be seen that the production at the end of the year is considerably below the average for the year. The average daily shipments for the year were about 60,000 barrels. These shipments may be treated as entirely gone to consumption, and in this view they fairly indicate the extent of consumption for the year.

The present daily average production is nearer the daily average consumption than it has been at any time in the past five years. The conditions in the producing field have also undergone a phenomenal change during the year. The Bradford and Richburg fields (which have been by far the largest in area and permanency that we have ever had) now exhibit unmistakable evidence of depletion and exhaustion; and the fewness of the new wells now drilling in these districts can only be accounted for by the fact that new ventures there do not promise to repay the investment. The only districts that can be looked to for supplying the trade for the present year are the Cooper Tract district and the Grandin Lease in Forest County, and the Bald Ridge district in Butler County; but these districts combined cannot, from their known character, be expected to maintain the decline occasioned by the depletion of Bradford and Richburg. Late drilling has already somewhat defined the Cooper Tract and Grandin Lease districts, and indicates the deposits to be limited "pool" deposits; and the Bald Ridge district is already marked by dry holes in close proximity with the best wells, thus showing its spotted and uncertain character.

In our opinion, nothing but the discovery of a new district like that of Bradford, will give us a continued accumulation of stocks and the low prices we have had for several years past; and fortunately for the holders of stocks on such district is at all indicated by any existing development.

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## TERRA COTTA LUMBER.

One of the most interesting and useful inventions made within the past few years is the process of making terra cotta lumber. The making of fire hardened clay materials, whether brick, tile, or vessels of any kind, carries us back to the dawn of history. While clay beds are to be found in vast quantities in almost all countries, the utilization of the material so lavishly bestowed by nature has been, for the most part, limited to brick and pottery. It is only recently that the idea has been suggested that a material might be produced from clay which would lack the brittleness of the articles so long known, and possess the exceptional and highly valuable quality of admitting of being cut and "dressed" into irregular shapes with edged tools.

Before our time anything constructed of clay had to be given its finished form while soft, and before the material had "set." Now we can make the material in large blocks, and afterward cut and shape it as we can lumber. This peculiarity, which is so valuable, is due to the same character of internal structure which wood possesses—that is, porousness. In proportion as wood is porous, within limits, of course, it is most useful for the vast varieties of building purposes to which it is applied. And so by making terra cotta porous we bring it more within the category of wood substances, and then properly name it "*terra cotta lumber.*"

It has similarities and dissimilarities of the utmost importance in contrast with wood and clay materials, and they seem to supplement each other. In other words, terra cotta lumber occupies an intermediate position between brick-like substances and lumber. It is, for instance, brittle and not fibrous, it lacks strength to resist the transverse strain which is possessed by wood, quantity for quantity; but it presents greater resistance to superimposed weight. It is fireproof, while wood is not, and it can be "dressed" by the plane and saw, which, generally speaking, clayey substances cannot be. In addition, it will receive and retain on its surface plastering or other surfacing without the application of lath. It must be borne in mind that, being at once an earthy substance and of open or porous structure, it possesses all the qualities which appertain to those two characteristics in all substances; and it possesses the advantages not belonging to substances not having these both.

As an article of commerce and use it may be produced easily, the clay being found at hand in almost any part of the country. Hence its cheapness; hence its universal utility. Compared with other commodities it may be called home-made, like those articles of universal use produced in the farm houses everywhere. It may be applied to domestic purposes on a small scale or to the largest public structures. Its uses, indeed, require no enumeration—they suggest themselves readily to the mind. Thus invention in the useful arts is steadily bringing into utility the products of nature, which otherwise would lie like worthless material on the surface of the earth. If clay were valuable only for brick, piping, etc., but a small fraction of the clay would be utilized; but with this process a very large percentage of it becomes immediately useful. In this material, what New Jersey alone produces may be taken as an example.

The belt of country underlaid by these clays extends entirely across the State, and, as described by Prof. Cook, the State Geologist, includes an area of 320 square miles; while the area within which these deposits have been worked up to the present time is only 68 square miles, the actual openings of the clay beds being only a fraction of this last area, so that, notwithstanding the hundreds of thousands of tons that are annually produced, the industry itself may still be regarded as in its infancy. The average depth of these clay deposits is about 400 feet, and their order of superposition is shown in the following table:

| | Feet. |
|---|---|
| 1. Dark colored clay (with beds and laminæ of lignite) | 50 |
| 2. Sandy clay, with sand in alternate layers | 40 |
| 3. Stoneware clay bed | 30 |
| 4. Sand and sandy clay (with lignite) | 50 |
| 5. South Amboy fire clay bed | 20 |
| 6. Sandy clay, generally red or yellow | 3 |
| 7. Sand and kaolin | 10 |
| 8. Feldspar bed | 5 |
| 9. Micaceous sand bed | 20 |
| 10. Laminated clay and sand | 30 |
| 11. Pipe clay (top white) | 10 |
| 12. Sand clay, including leaf bed | 5 |
| 13. Woodbridge fire clay | 20 |
| 14. Fire sand bed | 15 |
| 15. Raritan clay beds — Fire clay | 15 |
| Raritan clay beds — Sandy clay | 4 |
| Raritan clay beds — Potter's clay | 20 |

These clays form one of the most important elements of material wealth that the State possesses. Several hundred thousand tons of fire clay are dug annually and sent into market for making fire brick, fine pottery, sewer pipe, terra cotta ware, retorts, and crucibles, facing for wall paper, etc. The average price per ton is about $4, and the aggregate production of fire clay alone in its crude state exceeds $1,000,000. The stoneware clay from Perth Amboy is shipped to all parts of the United States, and supplies the material for most of the stoneware that is used in the country. Fine earthenware was formerly imported almost wholly from Europe, but within the last few years extensive potteries have been established at Trenton, which have been remarkably successful in the qualities of the wares made, and in finding a ready market for them. The Trenton potteries employ several thousand men, women, and boys, and produce several million dollars' worth of ware annually. Although the principal ware made is of the common white earthen and iron stone, the quality of which is fully equal to the best English ware of those grades, these works at Trenton also produce a much higher grade of decorated ware, that bids fair to supersede that which is now imported of this kind. The manufacture of pottery is rapidly increasing in quality and extent. The great abundance of the clay, its superior qualities, and its convenience to market have made it almost essential to the successful prosecution of some of the great industries of the country.

Our illustrations explain themselves, and require but a word of description. The terra cotta lumber is rendered porous by the simple though ingenious device of mixing in resinous saw dust with the wet clay, and when the clay has dried burning out the saw dust, thus leaving interstices in the brick like material. The fine clay, free from vitreous ingredients, is taken from the bed thoroughly mixed by means of small quantities of water with any desirable quantity of resinous saw dust, increased in proportion as it is desirable to make the product more porous. At Perth Amboy, where the works of the New York Terra Cotta Lumber Company are located, there are eight of these mixing mills in use, run by steam.

After a thorough mixing has been accomplished, the workmen shovel the mixture out of the mills and into a traveling trough, constructed of a wide leather belt and side walls, to the belt elevator, by means of which it is carried to the third floor. Here it is shoveled into a compressor, also worked by steam, through which it passes to the floor below, and is forced through a die into any requisite shape. Here, usually in the shape of large slabs, it is left to air dry. After partially drying here, it is carried to the first floor, and then dried on a brick flooring heated by flues running underneath it from grates, as shown in our illustration on first page. Here in a short period it is thoroughly dried and hardened.

It now goes, in the form of slabs, to the ovens, six in number, where it is piled up in layers, and, after all openings are closed, brought to an intense heat and all the saw dust burned out. This occupies forty-eight hours, and produces in that time about 180 tons of completed fireproof lumber.

It is now planed, tongued, grooved, sawed, etc., into any desirable shape, and this floor almost resembles a saw mill or carpenter's shop. The dust of the sawing is carried off by means of a steam blower.

In conclusion, we may enumerate some uses to which it may be applied. It is light, bulk for bulk, and may be united like joiner work or nailed into place like so much wood. In the waterworks of the Holly system it has been used and pronounced admirable for filters. Saturated with petroleum, it becomes a valuable fire lighter or kindling wood which may be used indefinitely. When immersed in boiling asphalt for a few moments, sufficient bituminous matter is absorbed to resist the action of water, for the asphalt becomes part and parcel of the material itself, and does not flake off when exposed to cold or dampness, as with common brick, solid terra cotta, or iron.

This fact and the splendid insulating qualities both of the material and the asphalt are now attracting the attention of electricians, and give reasonable hope that one of the problems of underground telegraphy has at last been solved.

The many future uses to which it may be put can be conjectured from the number of applications for patents being now made by Mr. Gilman, the inventor, for special purposes, to wit: Filters, underground electrical insulation, steam boiler and pipe sheathing, fire lighters, imperishable ground sills, waterproof brick, grain and elevator bins, refrigerators, safe and vault linings, fireproof jackets for iron columns, furnace linings, safety warehouses, etc.

Not the least noteworthy characteristic of this material is the fact that there is no waste in its manufacture, for the reason that all the remnants and edgings made by sawing, etc., find a market.

Up to this time, the factory of the company, located near Perth Amboy, N. J., has been engaged chiefly on architectural work for Columbia College, the H. H. Cook mansion, and other modern fireproof structures.

Samples of this fireproofing exhibited at the American Institute in this city received the medal of superiority, with a diploma. A new mill, the largest plant of the kind in the world, will be erected the coming season.

Patents have been granted by England, Canada, and Continental governments of Europe, as well as by the United States. The New York offices of the company are at 71 Broadway.

## The Dust in the Atmosphere.

BY DR. ASSMANN, OF MAGDEBURG.

Every one has noticed that when a ray of sunlight streams through a dark room, the air that otherwise seemed pure is seen to be inhabited by millions of very small particles. These little bodies are all embraced under the general name of "atmospheric dust."

There is a considerable difference in the general properties of this dust both in size and shape, as well as in weight. In size the particles of dust vary from several millimeters in the large flakes of soot from our factories, or the pieces of carbonized vegetable particles that are carried aloft in burning over swamps, down to the almost immeasurable particles that are designated by the term "cosmic dust," and probably result from the combustion of meteorites. They do not exceed in extent the ten-thousandth part of a small snow crystal.

If water from freshly fallen snow be evaporated under the microscope, we discover in it particles that derive their origin from all three of the natural kingdoms, animal, vegetable, and mineral.

Floegel, for example, found, in such cases, living infusoria and algæ, bacilli and micrococci, mites, diatoms, spores of fungi in immense numbers; also fibers of wool, mouse hairs, pieces of butterfly wings, skins of the larvæ of insects, cotton fibers, pieces of grass seed, bits of grass, epidermis, pollen grains, rye and potato flour, grains of quartz, minute pieces of roofing tiles, with bits of iron and coal.

The weight of the particles is limited by the possibility of their being sustained and floated on the currents of air. The larger their surface and the less the weight, the longer they will continue to float in the atmosphere.

Dust can be raised only by mechanical force, and this force is the moving air. If the motion of the air is horizontal, the quantity of dust lifted from the ground is comparatively small, particularly if the inclination of the surface varies but little from the horizontal. If the horizontal motion of the air is changed by a vortex or whirlwind into an ascending one, it raises a much greater quantity of dust. Those regions that have few or no plants in them are specially favorable to formation of ascending currents of air, in consequence of their being strongly heated by the sun's rays. But these very regions are most frequently covered with a fine grained, light soil that is easily carried off by the wind, so that we may consider our deserts as the chief source of the atmospheric dust.

It has long been known to seamen who sail in that portion of the world, that off the west coast of tropical Africa the atmosphere is often filled with a thick cinnamon colored dust, so that the coast is scarcely visible at a distance of five (English) miles. This dust consists chiefly of fine quartz sand, and of still finer yellowish detritus, mixed with very numerous organic forms. Hellmann has proved that the furnace which makes this "trade dust" is western Africa. The rain of dust thus formed often lasts ten days. and extends several miles from the spot where it originated.

In many cases masses of dust are precipitated from the atmosphere in form of rain, snow, or hail; hence snow and rain water not infrequently have a yellowish red color.

The phenomenon known as "rain of sulphur" depends upon an admixture of pollen with the rain.

Volcanoes furnish a second source of atmospheric dust. During the eruptions huge volumes of ashes and fragments of rocks are carried up into the air and borne to a great distance. The swamp burning common in northwestern Germany (and the forest fires in America) cause the formation of large quantities of dust

Fires for domestic and manufacturing purposes contribute a large percentage to the atmospheric dust. If we consider that in London over seven million tons of coal are consumed annually, and in the whole of England fifty million tons, and that the products and residues of this combustion are for the greater part carried into the air, it will be possible to form some conception of the quantity of dust derived from this source.

Finally we have to mention cosmic dust, which is referable to meteorites.

Concerning the actual quantity of dust floating in the air, Tissandier found in the air of Paris, after a week of dry weather, that there were 23 milligrammes in a cubic liter (or about 1 grain to 100 cubic feet). After a heavy rain there was about one-fourth as much (6 milligrammes to 1 liter).

The effect of the atmospheric dust is to diminish the amount of light and heat received from the sun, in the first place, and in the second to condense the aqueous vapors. An English investigator maintains that without dust no clouds could exist, no rain be formed; that dust is the nucleus on which vapors are condensed. Whether he is correct, farther research must decide.

The effect of atmospheric dust is of a manifold nature. Many plants owe their fertilization to the winds which carry the fructifying grains of pollen. But the moving air also bears along with it a number of germs that cause plant diseases, such as rust, mildew, and blight. Animal bodies suffer in two ways from dust, either by the mechanical irritation of delicate organs, or by infection. In the latter respect the recent investigations of Pasteur, Naegeli. Kock, etc., render it exceedingly probable that all infectious diseases are due to the introduction into the system of a specific living germ of disease.

Hence the dust of the atmosphere is a factor which, in a meteorological and morphological, as well as phainological and hygienic aspect, exerts an important influence on our ball of earth and its inhabitants. Its investigation and study is still in its infancy and will certainly bring to light many other very important results.—*Chemiker Zeitung.*

## City Telegraph Wires Underground.

It is gratifying to know that the Western Union Telegraph Company have decided to begin in earnest the work of putting all the wires of the company in this city underground. The first underground main will extend from the company's building at Broadway and Dey Street, up Broadway to 23d Street. The wires, it is said, will be laid in a tube large enough to contain 200 wires. The contract for this primary line has been given out, and work upon it will begin, it is promised, as soon as the weather will permit. The right to use the streets for this purpose was secured a few years ago. The promise is that, if the underground system adopted works well, it will be extended to all parts of the city.

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## Correspondence.

### Underground Steam Pipes.

*To the Editor of the Scientific American:*

In your issue of January 20 appears an article under the above caption, in which points are raised that do not meet my approval, although indorsed by yourself. The writer of the article is of the settled opinion "that the system will prove a blank and disastrous failure," and forms his opinion from three considerations: First, cost of original plant and subsequent repairs. Second, utility and convenience to parties who use the steam. Third, effect on public convenience, etc.

I chance to live in a city of 15,000 inhabitants, being the chief city and county seat of a county containing 60,000 inhabitants, with an area of 22 by 30 miles of the very richest soil for agricultural purposes, and underlaid at an average depth of 125 feet with an average 7 foot vein of coal for manufacturing purposes. My city is already a thriving manufacturing place, destined to become (in the language of our Mayor) "the Pittsburg of the West." It has upward of 15 miles of excellent macadamized streets, generally crowded with travel. In 1879, one Jacob Brosius, quite an enterprising citizen of our city, undertook the work of supplying our city with steam from a common source, by means of underground pipes in the streets, called the Holly system. A small piece of ground was selected for the location of the boilers, and about ten miles of pipe have been laid in the streets of the city. There are ten boilers at the supply works. The pipes were laid about four feet deep in the streets along the side, but not in the center, thus leaving plenty of room for travel and causing no impediment. The workmen employed first dug a ditch, and in this ditch placed a box well covered with pitch, called double air space insulating box, and on the bottom of this box they laid four inch tile. In this box were placed the steam pipes, and the ditch filled up to a level with the street and covered with macadam. The cost of all this was only $45,000.

Several factories, among them the renowned "Brosius Oil Works," public buildings, among them the court house, a large three-story brick building, and numerous private dwelling houses, are operated and warmed by steam supplied through these pipes from boilers one mile away. This proved satisfactory during the hard winter of 1879–80, and is working well now, with the mercury at zero. The pipes have not been touched since they were placed in the ground, and the traveler never knows he is walking or riding over the steam that is warming the city. The cost of repairing in three years is nothing, and if the whole pipe should give way at one time, which is hardly possible, it could be readily replaced.

The pipes laid in this manner are not subject to any change of temperature from the outside; and as factories run in summer as well as winter, they are seldom, if ever, permitted to cool off. The iron pipes are common steam pipes, and would require some time to wear out by the scaling off process I am disposed to say, then, that the "cost of the 'plant' and subsequent repairs" are not in the way of the success of the system. Nor is "the utility and convenience to parties who use the steam" against its success, but largely in its favor, for it is quite a comfort to have your rooms and halls at an even temperature all the time, meeting with no inconvenience in three winters. How often would a stovepipe have to be cleaned in that time? As to the inconvenience to the public, they know nothing about it. Of course steam supply companies may fail, but that will not prove that the system is wrong practically.

Of course these pipes are subject to corrosion and will wear out, but I fail to see why that should prove that the system is a failure. The same thing was said of the railroad enterprise, but what is the result? I think I know something about the practical workings of underground steam pipes, and I pronounce the system a decided success.

DON TURNER.

Belleville, Ill., January, 1883.

P. S.—I inclose you a model of the insulating box, and circulars explaining its construction.

[NOTE.—The statement that there have been no leaks or troubles or even repairs with the Belleville Steam Works, seems rather extraordinary, although the projectors have no doubt had a clear way for their pipes, and freedom from the blockade of sewers, gas, water, and electric pipes that have caused so much trouble in New York.

The wearing and cutting of the interior of the pipes, mentioned in a communication from a correspondent a few weeks since, have not yet had time to cause apprehension. It would be a great advantage to the reputation of the system as developed in New York, to have a detailed description and plans of this most perfect plant. If there is any advantage and profit in the system of street steam supply, it should be made apparent, if anywhere, in such plants as that at Belleville, Ill., St. Paul, Minn., and Lockport, N. Y., where, in addition to plane sailing, as the saying is, individual enterprise and strict economy have been the controlling influence in the engineering and financial policy.—ED. S. A.]

HUNGARY is entering the field of silk culture on a large scale. Reports for 1881 show that there were then 2,976 producers, who turned out 41,537 kilogrammes of cocoons, which yielded a profit that, augmented by State aid, provided for the establishment of a model school, which has already given great impetus to this industry.

### The American Collection for the London Fish Exhibition.

A Washington correspondent of the New York *Times* states that the collection of objects illustrating the fishing industries of the United States, to be shown at the exhibition of fish and fisheries to be opened in London on the 1st May, is substantially complete. As shown by the late census, the fisheries of the United States exceed in value those of any other country, and it is the design of the Fish Commission to make the American exhibit at London as superior to all others as our Berlin display was. The collection for this purpose is now distributed in the various departments of the National Museum, and, says the correspondent named, the visitor is amazed at its completeness. It shows both what has been done and what is being done to develop our important fishing interests, and comprises a complete representation of American ichthyology.

The exhibit contains a full set of plaster casts of all the important fresh and salt water fish of the national waters, modeled from natural specimens and colored from life.

These casts will be further supplemented with photographs of all the fish, each picture giving the exact length and size of the fish. To these are added alcoholic preparations of the fish themselves. All the works written on American fish are to be sent, with the fishing literature of to-day. To illustrate the whaling business every variety of harpoon, lance, and gun in use, with all the projectiles employed in the capture of the cetaceans, are shown on screens. This collection is endless. The archæology of whaling has been exhausted to make this exhibit perfect. There will be sent a perfect whale boat, thoroughly equipped with everything that is wanted, down to the tinder box. In this collection are exhibited the log books of former whaling cruises, which are very curious specimens of marine compilations.

When a whale is captured, it is the habit of the captain to print with a wooden stamp, right across the page, a picture of a whale, but when whales are seen and not captured, the fact of having sighted them is shown by means of another stamp, which presents the tail only of the creature. Looking over such logs, it is curious to notice that, considering the number of whales seen, few have escaped capture. All the makeshifts of the whaler, who is so long away from the land, have been brought together, such as strange lamps, manufactured out of tumblers, and other ingenious things. Here are rough skates, fashioned out of files, which some ice bound sailor has made and used, perhaps, for sport or to follow the sea elephants over the slippery ice. There are charts here, too, over which New Bedford skippers have pondered for many a long dark winter's day when nipped in the ice, wondering whether they could ever get free of the floes and track their way back to the New England coast.

Clever Yankee inventions are there here for slicing blubber so as to try out the oil, and various are the tubs, buckets, and pails in use in securing the oil. Here is a peculiarly formed vessel, which is lowered down into the head of a spermaceti whale, so as to bale out every drop of the precious oil. Old New England haunts have been ransacked in order to procure these objects, belonging to the past and present, all of which serve to explain the history of the whaling business. In a special portion of the museum building the heads of departments, with workmen under their charge, are placing the various objects on screens.

Two objects particularly attract attention. One is the bow of a whale boat, and on it is the figure of a harpooner as large as life, with arms outstretched ready to throw the iron. The other is the bowsprit of a sword fisherman, with a man out on the bowsprit, harpoon in hand, in the act of darting the grains into the *Xiphias gladius*. These two exhibits, which are exceedingly clever in conception, the action of the figures having been skillfully modeled, will decorate the entrance to the American exhibit in London.

In order to better explain the complete character of any department, that of the oysters will show as well as anything else that thoroughness which is the main object of the United States Fish Commission. The geographical distribution of all the edible mollusks on the American coast will be shown by means of maps. Then the biology and embryology of the oysters will be explained. Next will be shown the varieties of oysters and such differences as may be due to environment, with those changes having their origin in culture. The fishery of the oysters will then be illustrated with models of all the varieties of vessels, boats used, with the actual dredges, tongs, etc., which serve to take them.

A model of an oyster bed in its natural condition is being made, with other models showing how excessive dredging has changed its face. All the enemies of the oysters are to be exhibited. After this come the numerous methods of packing and canning oysters for food. For instance, a pungy dumps on a Baltimore wharf her hundreds of bushels of oysters, and in an hour afterward they have been opened and canned and ready for transportation. The apparatus and industrial methods are all to be shown by models. In this oyster exhibit alone there will be fully three hundred different objects.

An exceedingly novel feature of the exhibition will be the presentation of all the phases of fishing, illustrated in a pictorial way. To do this, photographic artists attached to the museum have traveled all along the coast and taken their prictues from life. Besides this, a whole series of sketches in crayon have been made illustrative of river and sea fishing. Every picture has attached to it a printed label. For instance, here is one entitled "Dressing Mackerel," which reads as follows: "On the left is a man splitting a mackerel. In the center another 'gibbing' or eviscerating the fish, which he holds in his left hand. The man on the right, dressed in a 'petticoat barvel,' is 'cutting away,'" etc.

Every stage, then, in American fishing is illustrated, from the way the fish is caught until it is finally prepared for food. Here are scenes of vessels caught in a gale of wind, with fishermen in dories rowing for their lives, in order to escape from the coming storm. Characteristics of the fishermen have not been overlooked. Here is a group of Irish fishermen who draw the net or set the line in and around Boston, who still, in a certain measure, adhere to the old country methods, using some of their Irish gear. Here are Portuguese, Malay, Kanacka, and Chinese fishermen, the gleaning of the American seas attracting labor from all parts of the world. The Indian porpoise fisherman is represented, who launches his frail boat and, with a rusty musket, rarely misses the ocean pig.

In food preparations the exhibition will be very comprehensive. Of canned fish over 200 various brands will be shown, almost every fish packing house of importance in the United States having sent samples. It may be stated, as showing how great is the development of this business, that $5,000,000 worth of general fish products are exported to-day from the United States, of which as much as $2,000,000 is represented by canned goods alone. The oil from the menhaden, the fertilizers, the fish glues, all find an appropriate place.

In fish culture, every process in use in the United States will be exhibited. One of the most attractive features will be a series of tables provided with the various apparatus. This apparatus may be divided into three departments—the closed apparatus, the trough, and the floating apparatus. There will be a large water tank, the water in which will be forced through the fish hatching appliances by means of a gas engine. Form, color, and appearance of the various kinds of eggs will be imitated by means of glass beads. Another important feature will be the models of a group of experts in the act of procuring the eggs and the milt from the salmon. These figures of life size will show exactly the manipulation used in stripping salmon.

There will be photographs of all the American fish which have been propagated by fish culture in the United States, as explaining the development of the egg; an entire series of specimens will be shown, illustrating the growth of the fish in the egg from day to day, to be followed with others explanatory of the size and condition of the fish after it has been hatched out. The fish hatching apparatus will be practical working ones, exactly such as are used, with all the appliances which serve for the transportation of the eggs, the young fish, the feeding troughs, the fish pens, with models of the cars used to carry young fish over the United States. Finally, on a large map will be shown all the hatching houses in the country, with the various points where shad, salmon, trout, white fish, carp, etc., have been distributed.

When the section of apparatus used by our fishermen is examined, the visitor is amazed at its magnitude. Here is a model of that vast net used by the mackereler, and to show its size a model of a mackerel schooner, with the seine boat, is suspended near it. Some idea is thus had of proportion. The lines, hooks, trawls, and engines of capture will fill innumerable cases. After this come the rods, reels, lines, and flies used by the angler. Here are cases of flies, with pictures of the insects which they imitate.

A fishing box—one of those light, portable houses which pack up in small space—will show our English friends how the American angler takes his ease. This house will have in it all the traps the angler may want, his bed, his store, and his cooking utensils.

Nothing has been forgotten or overlooked which might illustrate the ways and manners of our New England fisherman, for here are his amusements, his games, the literature he reads, the medicines he takes, the clothes he wears, the food he eats. There is the greasy pack of cards, thumbed almost out of existence, with which he plays euchre or high low jack, and the accordion that wails melancholy of nights, or the fiddle, which, when he scrapes, brings the wind.

As to books, his library is larger than one would think. There are his Bible, Shakespeare, Walter Scott, and next to it "Robinson Crusoe;" there are "Two Years before the Mast," all Dickens, with the "Red Rover of the Seas," and old Captain Marryat with the younger Russell. Here are love stories of the most languishing kind, with song books innumerable.

Fisherman Jack takes little medicine if he can help it, but here is his rough and ready pharmacopœia; plasters for his wounds, and castor oil, and blue mass, and one immensely big box, as large as a salt box, labeled epsom salts.

Were the description extended over innumerable columns, it would hardly give more than a scant idea of the thoroughness of this exhibition. All the sea birds, the animals which prey on fish, will be sent, together with all the primitive fishing gear in use by the American Indians. In addition to the objects illustrating fish and fishing, the Lighthouse Board and the Life Saving Service will send exhibits. Everything has been so arranged and systematized that the process of installation in England will require but very little labor.

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### Some Facts about Alaska.

Commander Henry Glass, U. S. Navy, who was for some time stationed at Sitka, Alaska, with the United States ship Jamestown, and afterward visited every part of the coast in command of the Wachusett, was in San Francisco recently, where he was interviewed with regard to the productions and possibilities of our great northern territory.

The fisheries of Alaska he thought very valuable, and destined to play an important part in the commerce and industries of the Pacific coast. Salmon of fine quality are found in the greatest abundance in every creek and river of the territory. It is probable that several canneries will be in operation this year (1883). The waters in places are teeming with halibut of the finest quality, and already the herring fishery has become of great value, works having been established during the past year for the manufacture of herring oil. Great numbers of whales frequent the inner channels and bays, and arrangements are now being made to prosecute whaling extensively. This can easily be done, and at much less expense than in the open seas, as small and inexpensive vessels can be used on the calm bays and channels of southeastern Alaska. To the northward and westward of Sitka are banks of considerable extent, where very fine codfish are found in great abundance.

The vast timber products of Alaska promise to be of great value in the near future.

On all the islands and the mainland of Southern Alaska are heavy forests of fir, spruce, alder, and cedar. Up to the present time very little timber has been cut in Alaska—only that needed for consumption in the Territory. But, with the inroads now being made on the timber of California, Oregon, and Washington Territory, Alaska must soon become a source of supply, and from the accessibility of the timber along the extensive shore line it can be exported very cheaply. On many of the islands are found large quantities of a hard yellow cedar, superior to any found elsewhere on this coast. This wood is quite hard, is easily worked, takes a high polish, is quite aromatic, and is said to possess the power of resisting the attacks of the teredo, which, if true, would make it very valuable in ship building. Commander Glass was told when in command in Alaska that the timbers of a Russian vessel constructed of this wood, after being some forty years under water, were found perfectly sound, and that they had not been touched by the teredo.

Of the mining prospects of Alaska, Commander Glass was quite hopeful. The placer mines of the Harris district are already valuable. During 1882 over $200,000 in gold dust were sent away, only the crudest machinery being used by the miners.

Quartz mining is equally promising in the same district, several extensive ledges having been discovered and traced one or two miles, and although only surface work has been done in prospecting, a great deal of fine quartz has been shown. The want of laws and courts to adjudicate disputed claims has prevented any extensive work being done up to the present time. With the organization of the Territory, capital would be attracted there and mines of value be developed.

Coal has been reported in several portions of the Territory, but as yet nothing of value has been discovered. Copper is reported in considerable quantities about the Copper River, to the westward of Mount St. Elias. This, however, Commander Glass had no opportunity to investigate.

At present nothing of importance is done in agriculture, only a few small gardens being planted about the principal settlements to supply vegetables. The summer is too short for any of our cereal crops, but potatoes of very fine quality could be grown in Alaska, and in all the valleys fine grasses grow luxuriantly, and portions of Alaska will hereafter be valuable for grazing purposes.

Southeast Alaska produces furs of value, and quite a large trade is carried on. Land and sea otter, lynx, several varieties of the fox—the most valuable being the silver gray fox—bear, and deer skins are exported, in considerable quantities.

Contrary to popular opinion, Commander Glass regards southern Alaska as an exceedingly healthy country, with a climate not at all severe. The lowest temperature that he saw recorded in Alaska during the two winters he was there was four degrees below zero (Fahrenheit); this was only on one day of January, of 1882, in latitude 59 degrees north. The highest temperature recorded on board ship during the summer was 80 degrees; this was at Sitka, about the middle of August. The mean temperature for December, January, and February, as found by hourly observations taken on board the Jamestown, was about 32 degrees (Fahrenheit). A great deal of rain and snow fall in southeastern Alaska, and there are few perfectly clear days during the year in what is known as southeast Alaska, say from Mount St. Elias to the southern boundary at Portland Canal. The climate of western and northern Alaska differs very greatly, and a very low mean temperature is experienced in that portion of the territory. This difference is largely due to the influence of the Japanese current, or Kuro Siwo, a portion of which is deflected by the Aleutian Islands, and impinges on the coast in about the latitude of Sitka.

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THE engineer constructing the Washington monument reports that it reaches a height of 340 feet.

### FLEXIBLE SELF-GAUGING FAUCET.

The engraving shows, in two views, an improved self-gauging faucet recently patented by Mr. William T. Robertson, of Montgomery, Ala. This device answers all the purposes of an ordinary faucet without being liable to the objections of wear and leakage, and at the same time it serves to indicate at any time the level of the liquid in the barrel.

A tap or tubular plug is screwed into the barrel or other vessel near the bottom, and on the outer end thereof is secured a flexible tube, which is about equal in length to the depth of the barrel. On the free end of the flexible tube there is a metal valve seat, to which is fitted a ball valve and a cage to retain the valve. The valve is so adapted to its seat that when the tube is vertical the valve is seated,

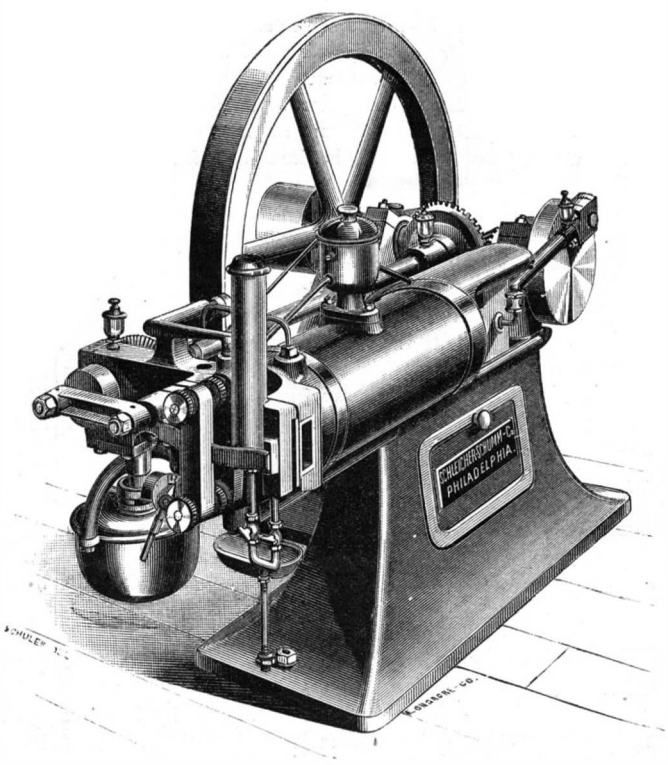
FLEXIBLE SELF-GAUGING FAUCET.

and when the tube is let down to draw liquid from the barrel, or to ascertain the level of the liquid in the barrel, the valve unseats itself and allows the liquid to escape, while the valve is retained by the cage in position to reseat itself when the tube is again put in a vertical position.

Near the upper end of the barrel spring clips are applied in position to secure the tube when in its vertical position. These clips are apertured transversely to secure a padlock to prevent theft. It will be noticed that this device is free from parts liable to derangement, and will at any time gauge the depth of the liquid in the barrel.

### THE NEW OTTO ONE-HORSE POWER SILENT GAS ENGINE.

Since the "Otto" gas engine was invented, and its practicability fully demonstrated, large numbers of them have been put into use in our cities where other engines could not be operated to any degree of advantage. The sizes made, however, were not below two-horse power, and the demand for smaller amounts of power could not be satisfied, on account of difficulty in making a smaller machine, at a cost proportionately reduced.




THE NEW OTTO ONE-HORSE POWER SILENT GAS ENGINE.

Messrs. Schleicher, Schumm & Co., Philadelphia, the well known builders of the "Otto" engine in this country, have now constructed a one-horse engine, which is offered at a proportionately reduced price, the special construction of the engine permitting a reduction in the cost of manufacture without sacrificing quality.

Our illustration shows the engine from a point that makes all its main parts visible, the governor being particularly apparent. This latter will regulate the speed of engine, and, at the same time, the consumption of gas, which varies in an automatic manner, in proportion to work done, from two to five cents per hour.

The engine has already found its way extensively into the workshops of jewelers, printers, and amateurs, and is seen giving attraction to the show windows of tea and grocery stores. For similar work the new size engine was purposely constructed, and the demand found for it is such that the makers cannot always fill it promptly.

The special features of gas engines, we suppose, are known to our readers. Above all, there are the advantages of perfect safety and cleanliness, there being no boiler, steam, coal, or ashes. A gas engine is also started at once whenever wanted, and is ready thus without preparation, and when stopped there is no continuation of expense. Engines of large size—as high as 25-horse power—are at present constructed, as well as smaller sizes, competing with steam, and surpassing it in many cases on the score of economy and absolute safety.

Illustrated catalogues, prices, and any information desired can be obtained by addressing Messrs. Schleicher, Schumm & Co., 33d and Walnut Sts., Philadelphia, Pa.

### Sandakan Harbor, Borneo.

Captain Green, of the steamer Tannadice, entered the harbor of Sandakan, North Borneo, on a recent voyage from Australia to China. He gives the Australian press an interesting description of the settlement newly acquired by Great Britain there. The harbor, he says, surpasses that of Sydney, not only in extent but also in beauty of scenery. From east to west it is seventeen miles, and from north to south fourteen, and its shores are thickly covered with magnificent timber, many of the trees being 300 feet in height. No fewer than seventeen rivers flow into the harbor, two of them being navigable for twenty miles inland for vessels of a draught of twelve feet. The Kinibatangan River, a little way down the coast, is described as being navigable for 400 miles, with a draught of twenty-six feet when the bar is crossed. The town of Elopura is built on rising ground about a mile and a half inside the harbor, and already contains a population of 3,000 Chinese and natives. The climate is reported to be exceptionally cool for the tropics.

### Wooden Ship Building in Maine.

In an extended review of wooden ship building in Bath, Maine, the Boston *Advertiser* shows that Bath is not only tha greatest wooden ship building place in the United States, but the greatest in the world. The value of the shipping built there within a century past is estimated to be upward of $50,000,000. The largest annual production was in 1854, when 64,327 tons were built, or 87 vessels. Of this number 59 were ships. In the ten years ending 1840 the building amounted to 69,559 tons. The next decade showed a gain of about 70 per cent, the total being 118,732 tons. Between 1850 and 1860 the product nearly trebled, and reached 324,888 tons. The war period brought the yield of the next term down to 163,539, but between 1870 and 1880 there was a gain of 37½ per cent, giving a total for that period of 225,046 tons. During the past year the tonnage of vessels launched at Bath was 39,090, with vessels of 13,520 remaining on the stocks. The cost of a completed wooden ship, or other new vessel, is reckoned at from $50 to $55 a ton.

The vessels launched last year at all the Maine ship yards gave a total tonnage of 62,567 tons, with 23,016 tons on the stocks. The official report of the wooden ship building of the whole country for the year ended June 30, 1881, places Maine at the head, with 41,374 tons. Next in rank is Michigan, with 5,852 tons. Then come Massachusetts, with 4,723 tons; Wisconsin, 3,429 tons; Pennsylvania, 3,278; and California, with 3,197 tons.

In one of the Bath ship yards is a planer, said to be the largest in the world. It is capable of working a keel piece of timber sixty-six feet long, five feet wide, and two and one-half feet deep. The keel comes out of the machine ready for laying on the blocks, and perfectly smooth and true on all sides. A beveling saw is another capacious machine, which turns out timber sawed at any desired angle from the horizontal, and by it curved timber and ship knees can be worked true to the line.

The steam engine which runs these machines runs also a bolt cutting machine which will nip off round iron of any diameter up to two inches; also a large and a small circular saw, a machine for making tree-nails, and, in the finishing shop, a band and circular saw, a planer, moulding machine, and a plug and wedge machine. The waste steam is used in bending timber. A plant for the construction of iron ships is now under way, and it is expected that the first iron vessel will be begun in May.

### An Asbestos Balloon.

A fire-balloon has been made, in which the lower part is constructed of asbestos cloth, while the upper part is covered with a fire-proof solution. A spirit-lamp is used to supply the hot air for inflating it, and, being fire-proof, there is no risk as with ordinary hot-air balloons. The system is said to be specially valuable for war balloons, as a supply of spirit can be easily carried where it would be difficult to take the appliances for preparing gas.

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### A GLASS GLOBE FROM WHICH THREE HUNDRED WATCH CRYSTALS WERE CUT.

Our illustration shows a hollow sphere of glass now in possession of L. Royer, in Paris. The diameter is not stated, but the size can be judged from the fact that three hundred watch crystals have been cut out of it. The cut is taken from Ackermann's *Gewerbe Zeitung*, and is from an actual photograph.

### THE AUTOMATON CHESS PLAYER.

A few days ago the newspapers announced that the police of Bordeaux had forbidden the exhibition of the automaton Az Rah, one of the attractions of the Exhibition Theater, because it had been discovered that the manikin was set in motion, not by mechanical arrangements, but by a youth of eighteen years, inclosed within a cavity behind the wheelwork, and whose health was gravely compromised by this daily torture.

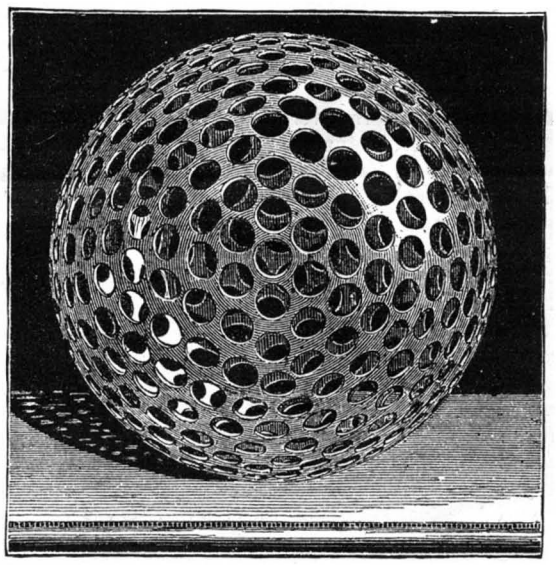
This automaton recalls the famous Turkish chess player that was constructed in Hungary by Baron Kempelen in 1769, and exhibited in Germany, Russia, France, England, and America, without the public succeeding in ascertaining its mechanism. In 1819 and '20 a man named Melzer showed it anew in England. Robert Houdin saw it in 1844 at the house of a mechanician of Belleville, named Cronior. Since then its fate has been unknown, and it is very probable the Az Rah of Bordeaux is nothing else than the Turk of Vienna. Our readers who have seen it at the exhibition will be enabled to decide the question after reading the description that we shall give. Baron Kempelen, a Hungarian nobleman and an Aulic Councilor of the royal chamber of the Domains of Hungary, being at Vienna, was called to the court to be present at a seance of magnetism that a Frenchman named Pelletier was to hold before the Empress. Kempelen was known as an ingenious amateur of mechanics, and the persons present having asked his opinion in regard to the experiments which he had witnessed, he happened to say that he believed that he could make a machine that would be much more astonishing than anything that he had just seen. The Empress took him at his word and expressed a desire that he should begin the work. M. De Kempelen returned to Presbourg, in his own country, and, in six months, produced an automaton which played a game of chess against any one who offered himself, and nearly always won it.

This automaton was a human figure of natural size, which was dressed in the Turkish style, seated on a chair, and placed behind a wooden chest on which was laid the chessboard. He took the pieces up with his hand in order to play them, turned his head to the right and left in order to see them better, and nodded his head three times when he checkmated the king, and twice on attacking the queen. If his adversary made a mistake, he shook his head, removed the wrongly played piece, deposited it outside of the chessboard, and played his own. The showman, who stood near the automaton, wound up the mechanism after every ten or twelve moves, and occasionally replaced certain wheels; and, at every motion of the Turk, were heard noises of moving wheelwork. To show that there was nothing within but mechanism, doors were opened in the chest and body. There was also a magnet lying on the table to make believe that magnetism, then in great vogue and as yet full of mystery, played a preponderating role in the affair. M. De Kempelen was accustomed to say: "The machine is very simple, and the mechanism appears wonderful only because all has been combined with great patience in order to produce the illusion."

Many hypotheses were put forth on the subject; and two books, one published in 1785, and the other in 1789, were devoted to a discussion of them. Those that appeared to be most likely were, on the one hand, that the Turk's body contained an extraordinarily small dwarf, and, on the other, that the showman acted upon the automaton from a distance by the aid of magnetic influences. These two explanations gave a very imperfect account of the facts, and it was not until some years ago that the trick was unveiled in an anonymous book.

The following is an exact description of the apparatus and the successive operations performed by the exhibitor:

The chest was 3½ feet long, 2 feet wide, and 2½ feet high, and was provided with doors and drawers whose use will presently be seen. The front part of the chair seat was affixed to the chest, and the back part rested on the floor by two legs which, as well as the four legs of the chest, were provided with casters. The right hand of the manikin was movable on the upper part of the chest that formed a table, and, at the beginning of operations, held a pipe, which was afterward removed, and it rested upon a cushion lying in a certain definite position. The chessboard in front of the player was 18 inches square. The exhibitor, provided with a light, begins by allowing the interior of the apparatus to be examined by the spectators. He opens the door A (Fig. 1), and allows to be seen a series of gearings that occupy the whole width of the chest. Then he passes behind and opens the door B (Figs. 2 and 8), opposite the door A, and introduces a light into the interior to show that it is empty. The spectators standing on the other side can, in fact, see the light shine through the different pieces of mechanism



A GLASS GLOBE FROM WHICH THREE HUNDRED WATCH CRYSTALS WERE CUT.

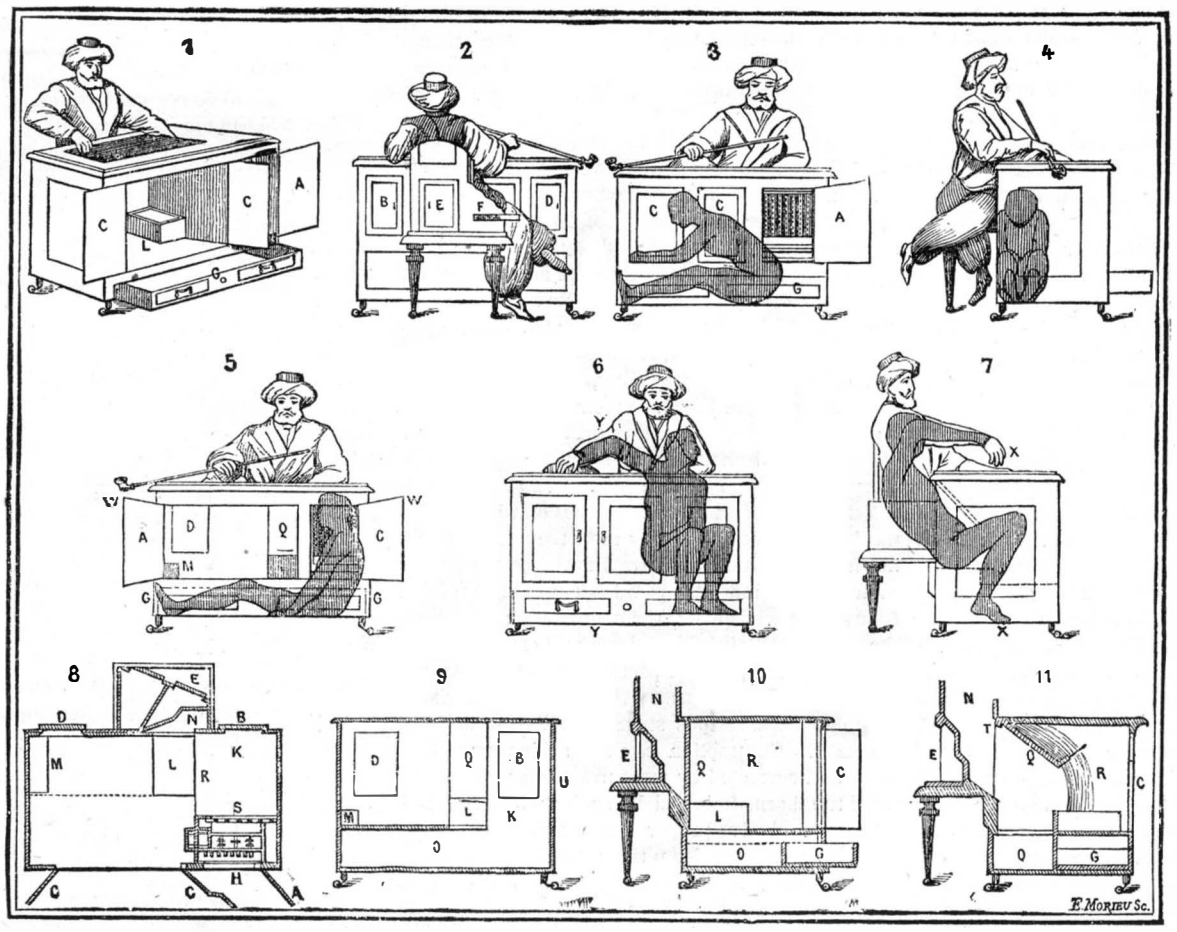
through the door A, that remains open. He afterward locks the door B, and comes in front of the chest and opens the drawer G, from which he removes the chessmen, and a cushion which he slides under the left arm of the automaton. This draw appears to serve no other purpose than the preservation of these objects. Finally, he opens the two doors, C C, in front of the chest, and shows a large closet lined at the sides with dark drapery, and containing two boxes, L and M, of unequal size, and a few belts and pulleys that seem to be designed for putting in motion the mechanism contained in the boxes. Passing behind again, he opens the door, D, and introduces a light into the interior of the chest to show that it has not a false bottom. Then he closes this door again, and also the doors A and C, by means of the same key. Next he turns the apparatus around so as to show the public the other side (shown in Fig. 2), and raises the clothing of the Turk, and opens the apertures, E and F, in the back and thigh to show that no one is hidden within. These doors remain constantly open afterward. Finally, the showman turns the Turk back to his former position facing the spectator, removes the cushion and pipe, and then the game may begin.

We shall explain as clearly as possible how the game was directed by a man who succeeded in hiding himself by a series of movements when the different doors of the apparatus were successively opened:

The drawer, G G, when closed, does not reach the back side of the chest, but leaves between it and its back an empty space, O, measuring 14 inches in breadth, 8 in height, and 2 feet 11 inches in length (Figs. 9, 10, and 11). This space is never shown to the spectator. The little closet extending from A to B is separated into two parts by a dark hanging, S (Fig. 8), which is raised when the door, B, is opened, and lowered when it is shut. The front part of the closet is entirely filled with the wheels that are thought to move the automaton. The back part is empty and is separated from the large closet that the doors, C, form by a thick curtain, R, which hangs freely, being only fixed at its upper part. A part, Q, of the bottom partition of the large closet, C C—the part in front of the Turk—is movable around a horizontal axis, and is provided with a weight toward the interior of the closet sufficient to cause it to fall always in a vertical position. The box, L, is movable and serves to hide an aperture in the floor of the closet; and the box, M, is stationary, but has no bottom, and covers likewise a corresponding hole in the lower floor over the space, O. The interior of the Turk is arranged as indicated in Figs. 8, 10, and 11. Finally, the end of the chest to the right of the Turk slides in horizontal grooves (properly hidden) in such a way as to give access to the space, K. It will now be seen that if a man of small stature introduces himself on this side into the chest, he will be able to thrust his legs into the empty space hidden behind the drawer, and to place the rest of his body in the space, K, as may be seen in Fig. 5, and by pushing the curtain before him and removing the movable box, L, he will be able to assume the position shown in Figs. 3 and 4. It is in such position that he awaits the beginning of the exhibition. The box, M, serves for receiving the extremity of his feet.

It will be remembered that the first operation of the exhibitor consists in opening the door, A, at which time the public sees only the mechanism, and, behind it, the dark curtain, S, whose distance cannot be estimated. The exhibitor next passes behind the chest, and, opening the door, B, introduces a light behind the mechanism, which is believed to occupy the whole width of it. The curtain, S, being raised, it is seen by the light that shines through the different pieces that they cannot serve to hide any one. He then closes and locks the door, B, and, returning to the front, opens the drawer and performs the operations already described, in order to give his confederate time to take the position shown in Fig. 5. The box, L, having been put back in place, as well as the curtain, R, the public sees only an empty space when the doors, C, are opened. The curtain, S, which has fallen, hides the back of the confederate, although the door, A, remains open; and it is then that on introducing the light through the door, D, the exhibitor shows that the large closet has not a double bottom. The doors, C, being again closed with the same key, so as to make believe that these different closings are due to the necessity of removing this key at every operation, the chest is turned around, the two doors, E and F, are opened before the public to show that the body of the Turk is empty, and finally the machine is wound up slowly, the wheelwork making considerable noise the while. During this time the confederate raises the movable partition, Q, takes his legs from behind the drawer, introduces the upper part of his body into a portion of the manikin, which is so arranged as to give his loins a convenient support, and seats himself on the box, L, as shown in Figs. 6 and 7. The game may then begin, the hidden player following his moves through the sufficiently transparent fabric that forms the Turk's clothing. In order that the confederate may easily introduce his arm into that of the manikin, it is necessary to give the latter a certain position, this being the reason for the addition of a pipe in the hand and a cushion under the elbow, both of which are removed when the game begins. A simple cord permits of moving one of the manikin's fingers so as to pick up or drop the chessmen The left arm of the confederate, which remains in the machine, is employed in moving the head and in producing the noise of wheelwork at every motion.

In reality, in M. De Kempelen's automaton, it was the left arm that moved the pieces. It is said that this peculiarity was due to the fact that the chess player who operated the automaton was left handed. There has even been a touching romance related on this subject, to the effect that the




THE AUTOMATON CHESS PLAYER.

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hidden chess player was a Polish officer who, having been compromised in the revolt against Catharine the Great, and having lost his two legs in fighting, was received by Kempelen, who thus hid him so well from the searches of the Russian police that he could go to conquer his sovereign in the game in the midst of her court.

The figures which accompany this article are a reproduction of those that were inserted in the anonymous book that we have mentioned. They were very imperfect and not on the same scale, and we have corrected them slightly to render them intelligible.—*La Nature.*

### Boots vs. Shoes.

The *Shoe and Leather Reporter* calls attention to the remarkable change that has taken place in men's foot gear during recent years, and attributes to it some notable changes in the leather trade. Less than thirty years ago, the man who wore shoes was an exception. It was heavy boots, common boots, and light boots—boots for the field, the workshop, the drawing room, or the dancing saloon, but always boots. In very hot weather low shoes were sometimes admissible, but the tailor would always insist that no gentleman should wear shoes in full dress, since without the boot legs the pantaloons could not sit well. It would seem, in fact, that boots came in as knee breeches went out; for in the days before Blucher and Wellington buckle shoes and small clothes were the rule. The return to shoes began shortly before our civil war, the first styles being button or laced shoes coming to the ankle.

In the early part of the war, the prescribed army shoe was pretty generally rejected by officers and men, who soon learned, however, that for long marches and heavy campaigning the despised shoes were the best. After the second year boots were a rarity in the army, except, of course, among the cavalry.

There is no doubt, the *Reporter* thinks, that the general change from boots to shoes was hastened if not largely brought about by army experience. At the West the boots held out longer, but at present they form a very inconsiderable feature in the stocks of most retail stores. An ordinary average of sales is six pairs of men's shoes to one of boots. In the cities the proportion of boot sales is even smaller, and the man wearing boots is almost looked upon as an old fogy.

According to the recent census report, the total product of boots in the United States for 1880 was 30,590,876 pairs, and of shoes, 94,887,615 pairs. Under the heading of boots, however, is included all goods for men, women, or children that are button or lace fastened. This would reduce the number of regular men's boots to probably not to exceed 15,000,000 pairs out of a total of 125,478,511 pairs of all kinds of boots, shoes, and slippers, according to the census figures.

Aside from the curious feature of the change in styles, the *Reporter* notices a practical question for tanners as to how far the decreased manufacture of boots affects the consumption of leather. The ordinary boot leg above the ankle takes from one and one-half to one and three-fourths feet of leather, or not less than three feet to the pair, which is about as much as is required for the foot portion of the boots. In round numbers we might say the consumption of upper leather for shoes is only one-half as much as would be required for boots. Thus considering the subject, it appears that a production of upper leather that would be sufficient for, say, 15,000,000 pairs of boots in 1870 would still be ample for 30,000,000 pairs of shoes in 1880. The increase in the production of upper leather since 1870, while it has not been in proportion to the growth of boot and shoe manufacturing, has unquestionably been somewhat in excess of the actual demand for the leather, so that the buyers have had the advantage. Whether there is still an overproduction or not is an open question, but from the small stocks of upper leather, including calfskins, now offering in the principal markets, it looks as though the point of equilibrium had at last been reached. If this proves to be the case, and the business of the coming season will develop it, then any further growth of the boot and shoe manufacturing must have a direct effect on the leather markets, and the demand will have to be met by a corresponding increase in the activity of tanners. It must also be borne in mind that, although boots are on their last legs, so to speak, just now, there is no certainty that they may not again come into favor. Fashions have a curious way of repeating themselves, and if boots were the style we would all wear boots, irrespective of considerations of comfort or convenience, just as we now wear shoes. The tanners can, therefore, look forward to great possibilities.

### The Earth a Great Magnet.

This was the title of a lecture recently delivered by Professor Silvanus P. Thompson at Glasgow, under the auspices of the Glasgow Science Lecture Association. Professor Thompson traced the history of magnetism from the time of Dr. Wm. Gilbert, one of the physicians of Queen Elizabeth, by whom it was raised from the region of superstition and fable to that of true science, remarking that in Gilbert's book he had found the title of his address, "The Earth a Great Magnet." According to *The Electrician* (London), from which we copy, he showed by experiment the properties of the loadstone, of the magnet, and of the mariner's compass, and pointed out the various modes in which a magnet might be formed. He illustrated the declination of the magnetic needle, and explained the difference between the magnetic and geographical poles. The magnetic pole, he stated, was at present near Boothia Felix, more than a thousand miles to the west of the geographical pole. In 1657 the position of the needle showed the magnetic pole to be due north. It had been eastward before that. It then began to point westward, and the westward variation increased till 1816, when the maximum was attained. It had since steadily diminished, and in 1976 it would again point to the true north. The changes which had been observed, not only in the direction but in the strength of the earth's magnetism, showed that the same causes which originally magnetized the earth were still at work. Strangely enough these changes did not occur at long intervals in the course of centuries, but were going on from day to day, from week to week, and from year to year. This was illustrated by those magnetic storms which interrupted telegraph operations, rang telephones, and, as was reported lately, kept one of Edison's lamps alight, though he would have liked to have seen it.

These magnetic storms were most frequent in the month of May and fewest in June, again reaching their maximum about October. It had also been observed that the more violent the magnetic storms the more numerous were the spots on the sun, and the more brilliant were the auroral displays around the poles. The phenomena of the aurora were among the mysteries of science, of which no explanation had been given; but it was certain that the aurora was an electrical discharge passing from the equatorial regions through the upper air and descending at the poles, where a condensation of vapor was continually taking place. The earth was thus continually surrounded by electricity, and here, he thought, was to be found the answer to the question, How did the earth become a magnet? That it was not always a magnet he regarded as certain, seeing that there were good geological grounds for believing that it was once a molten mass, and that nothing destroyed magnetism like heat. Faraday had found that by taking a bar of iron, spinning it on its axis, and carrying a current of electricity round it from the center to the poles, a magnet was formed. As, therefore, there was a current of electricity continually flowing from the equatorial regions to the poles and returning again to the equator, he put forward as a guess that in this way the earth revolving continually on its axis had been converted into a magnet. This theory, of course, involved that the magnetism of the earth had been growing, was growing, and would continue to grow.

### Contracted Feet and Proper Shoeing.

Contracted feet are more commonly the consequence of lameness in horses than the cause. Any diseased condition inside the hoof giving rise to an unusual degree of heat leads to a more rapid evaporation from the surface of the horn, to drying and shrinking of the hoof, and to absorption of the soft parts within. The shrinkage or narrowing takes place especially at the heel, where the foot has not a long, but only an elastic, cartilaginous internal support, which yields easily to any pressure from without. A second condition, which always coincides with this drying due to disease, is the disease of the heel caused by the animal standing on its toe, or removing the weight from the entire foot. When the foot is planted on the ground and the weight thrown upon it, the soft parts descending within the hoof tend to press it outward, and as a matter of fact the hoof does actually expand at the upper part, next the hair, and thus the natural tendency of the unused elastic horn to contract is to a great extent counteracted. Disease is, therefore, a more common cause of contraction, and in all cases of contracted feet it is well first to look for some existing disease, such as corns, bruises, pricks, and other wounds, graveling, thrush, inflammation from uneven bearing of the shoe, from the nails being drawn up too tight, from navicular disease, from ringbone affecting the second or third phalanx, and so on.

Apart from any disease sufficient to cause lameness, contraction of the feet sometimes goes on to an extreme degree, until, indeed, one heel may meet the other; yet lameness is not induced. Yet, if contraction takes place with rapidity, as under the influence of a long period of rainless weather following a wet spring, the compression of the soft parts by the drying and shrinking horn will cause inflammation and lameness. During the past dry summer this was not uncommon, and the lameness thus started bade fair, if neglected, to go on to serious structural disease and a permanent lameness. Contraction caused in this way may be counteracted and corrected by measures calculated to soften and expand the horn, followed by such as will retain its natural moisture and give proper bearing on the shoe. To soften the contracted foot, keep the unshod animal standing every day for sixteen hours in a stream of water coming up to the hair around the top of the hoof, or in a soft muck of clay puddle closing in around the foot to the same level. In frosty weather a warm poultice placed in a strong bag drawn over the foot is preferable, the more so that it can be kept applied night and day. At the end of a fortnight the foot will usually be found to have expanded to its natural dimensions.

If there is much lameness, it will be desirable to apply a blister on the front and sides of the pastern during the period of poulticing. This may be repeated and the poulticing continued, if lameness remains at the end of a fortnight. As a blister, the following may be rubbed into the skin on the front and sides of the pastern: Powdered cantharides, one-half drachm; oil of lavender, ten drops; olive oil, one ounce. It may be repeated the second day if heat and tenderness have not been induced by the first application, and also as soon as the effects of the first application have passed off and the resulting scabs have dropped off. When lameness has disappeared, and the foot has been sufficiently expanded, it should be dressed carefully, going the same height to the wall at all corresponding points on the inner and outer sides, and paring heel and toe in proper ratio with each other, the sole being left as far as possible to come to the heel with the hoof wall at all points, and furnish with it a surface of bearing for the shoe.

The shoe should be perfectly loose and smooth, and when applied should press evenly at all points. It should be drawn only moderately tight, and on giving its final dressing the use of the file should be as far as possible avoided. The horn is formed of a series of pus tubes with an intertubular cellular structure, and when the rasp or file is used so as to expose the open ends of these tubules the contained moisture exhales, the horn withers, and the soft parts may be injuriously pressed upon. For this reason the use of the file on the front of the hoof is to be severely deprecated. It should only be used on the lower edge of the hoof wall, where it projects over the shoe, and when the sharp edges might otherwise split up. For a similar reason, the sole should never be pared down into the tough, elastic horn, though all scaly masses on the surface may be safely removed. After shaving, the use of hoof ointment will serve to prevent evaporation and drying, and is absolutely needful after the foot has been softened by poulticing. A mixture of equal parts of wood tar and sweet oil will answer admirably. This brushed daily over the entire surface of the horn—wall, sole, and frog—will usually preserve a sufficiency of moisture and the natural elasticity and toughness of the horn.—*Prof. J. Law, in Irish Farmer's Gazette.*

### Crow and Snake.

While riding down through Occum, Conn., on May 26th last, we noticed a crow on a level garden bed killing a snake, which was not less than eighteen inches long. The snake seemed fully conscious of what was going on and tried to get away, but showed fight every time it was seized. It was interesting to see the crow bite him, lift him up, and throw him to the ground, keeping one eye on us the while. This went on for some time, the snake getting weaker every bout.

The crow evidently not liking the nearness of myself and carriage, seized the snake within a few inches of its head and flew with it into the large trees beyond the Wequonock River, where we could not watch its further operations. The snake hung down its full length while being carried over the river. Crows are great scavengers, especially while they have young in the nest, and during this time they will carry off more very young chickens than any hawk in North America.—*Ornithologist.*

### Pearl Patterns on Cloth.

Flexible mother-of-pearl patterns are produced on cloth stuffs, according to a recent German patent, as follows: On a soft elastic base is placed thin caoutchouc as large as the pattern, and upon this a thin plate of copper, with the pattern cut through. Over the copper is placed the cloth on which the mother-of-pearl pattern is to be produced. A heater is now passed over the whole, with the result of melting the thin caoutchouc, and causing it to be pressed up against the cloth, in form of the pattern. The cloth is now removed with its adhesive pattern, and powdered mother-of-pearl is sprinkled on it; then a heater is passed over it, and any superfluous powder is removed with a soft brush. A fine crape-stuff, moistened with gum solution, is next laid on the mother-of-pearl pattern, and, after drying, adheres to it with protective effect, while the varying color of the mother-of-pearl is but little affected.

### Rum in Switzerland.

Among other matters discussed at the Congress of Hygiene which recently met at Geneva, was that of intemperance, which M. Roulet showed to be making rapid progress in Switzerland. He desired heavy duties on the sale of drink, especially distilled liquor, severe surveillance of it, and energetic repression of drunkenness. He insisted on the utility of temperance societies, and said, in closing, that the war against intemperance would not succeed till all alcohols, except ethylic, were removed from beverages. It is necessary to find a reagent enabling to determine accurately and quickly the quantity of those other alcohols in the drink. M. Alglave advocated monopoly of the sale of alcoholic liquors by government. The Congress passed a resolution calling on all Governments to abolish legislative obstacles to the practice of cremation, and urging the advantages of this practice in the case of serious epidemics.

### Lightning in January.

Lightning began its work early this year. On the last day of January a brilliant flash lighted up this city, attended by a loud peal of thunder. In Brooklyn a dwelling house was struck and materially damaged. A mother and child were hurt, and shocks were felt in streets and houses for several blocks around. Telephone bells were set to ringing, and in most of the telegraph offices startling electric effects were experienced. The superintendent of the police telegraph department said that the current came into headquarters with fearful volume, all the annunciators were knocked down, and a relay was burnt. Fortunately no one was using the telephones at the time.

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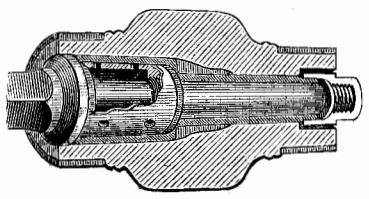
## RECENT INVENTIONS.

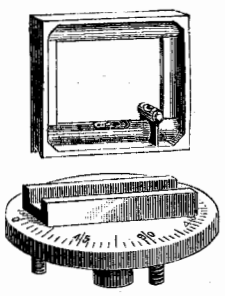
### Improved Vehicle Axle.

The engraving shows an improved vehicle axle recently patented by Mr. John J. Maroney, of Bergen Point, N. J. The axle is made with a collar at the inner end or base of its arm, in the usual manner. On the axle at the inner side of the collar is formed a second collar to receive and fit into the end of a hollow cylinder, which is made of a larger diameter than the diameter of the axle, and has an inwardly projecting annular flange, formed upon its inner end. The edge of this flange has a screw thread formed in it to fit into the thread formed upon the collar on the axle. The space between the cylinder and the axle is to receive oil or other lubricant, and may be filled with cotton waste or other packing, if desired. In the shell of the cylinder is formed a number of holes through which the lubricant can escape to lubricate the outer surface of the cylinder and the surface of the part of the thimble skein or axle box that fits upon the cylinder. In the top of the arm of the axle is formed a long groove, and in the bottom and sides of the axle arm are formed short grooves. Both grooves pass through the collar and serve as channels to conduct the lubricant from the cylinder to the forward part of the axle. The thimble skein is made with an enlargement at its inner end to receive the cylinder, and is provided with wings to prevent it from turning in the hub. In the engraving parts are broken away to show the internal construction.



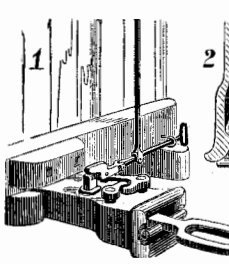
### Improved Instrument for Leveling, Surveying, etc.

The object of this device is to combine into one compact instrument the different tools used by engineers who erect machinery, foundations, shafting, bridges, etc. The instrument consists of a rectangular frame, carrying in its lower part a longitudinal and a transverse spirit level. The top part of the instrument is hollowed out for a telescope tube, having a center on one end and a wire cross at the other end. The instrument can be used as a try square, as a spirit level, as a spirit plumb, and, with a small addition, as an inclinometer. The telescope tube is intended to facilitate the erection of such pieces as are required to be in a straight line toward a given distant point, as for instance parts of line shafts, etc. In this case the engineer places the instrument on the shaft he wants to adjust; he then looks through the telescope tube toward the given distant mark, which mark shows the point where the shaft is to go through the wall, and he then adjusts the shaft until he can see the desired mark through the telescope, the shaft then being in proper alignment, and level. This instrument may be provided with the foot of a surveying instrument, as for instance the one shown in the engraving, which is formed of a shoe having a center in a graduated plate, the plate having adjusting screws for vertical adjustment. Thus it will have all the requirements of a common surveying instrument. The principal feature of this device is its compactness considering the many uses to which it is adapted. The instrument has been patented by Rudolph Peter, P. O. Box 40 Hartford, Conn.



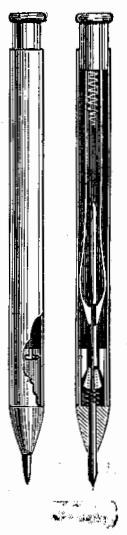
### Improved Car Coupling.

This invention is designed to improve the usual means for uncoupling the pivoted wings of a drawhead from an arrowhead link, and for holding the link up in front, so as to be conveniently guided into an opposite drawhead. The drawhead is provided with an inwardly-tapering end opening, behind which the opening in the drawhead is straight, and provided in each side with a recess or groove, in which are placed wings (Fig. 2) adapted to swing laterally, and mounted on vertical shafts journaled in the top and bottom of the drawhead, the upper ends of the shafts projecting from the top of the drawhead. Hooks projecting toward each other, so that the point of one rests against the shank of the other, are rigidly mounted on the upper ends of the wing shafts. One hook is provided with an arm, to the end of which an angle lever is pivoted, the outer end of this angle lever being pivoted to a horizontal movable rod, which extends to the side of the car. A lever pivoted to the rod extends to the top of the car for operating the coupling from the car top. The cars are coupled automatically, the end of the drawbar entering the drawhead, pressing the wings laterally until the arrowhead has passed. Then the springs hold the ends of the wings against the shank of the drawbar, and prevent it from being withdrawn, as the shoulders of the drawhead strike against the ends of the wings. When the cars are to be uncoupled, the rod is drawn toward the side of the car, turning the shafts, so that the wings will be swung from each other, thus permitting the drawbar to be withdrawn. If the rod is moved in the opposite direction, the inner end of the angle lever will be pressed on the head of the pintle, and the pintle will be pressed down into the drawhead, and depress the inner end of the drawbar, thus raising the outer end, to guide it into the opposite drawhead. This coupling is the invention of Mr. B. F. Metz. Further particulars may be obtained by addressing Messrs. B. F. Metz and J. Kauffmann, Osborn, Ohio.



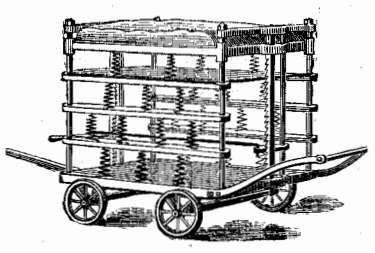

### New Pencil Holder.

The engraving shows a pencil holder having spring jaws for pushing the pencil outward, and conical jaws held to their seat by a spring for holding the pencil against the return movement of the push jaws, the whole being inclosed in a case. The tubular case of the holder is made of convenient length and size, and into the upper end is fitted a short tube having a knob or cap upon its outer end, held up by a spiral spring. The movement of the short tube is limited by a pin projecting from a slot in the side of the case. To the inner end of the short tube are attached the upper ends of two springs which extend downward and are curved outward, and the bends thus formed rest against the inner surface of the case, so that their elasticity will force the jaws, formed upon their lower ends, inward to grasp the pencil or lead. As the tube and springs are pressed downward, these jaws clamp the pencil and force it downward. The lower end of the holder is made conical and fits upon the pencil. The upper part of the point is made tubular in form, and of such a size as to fit into the lower end of the case, where it is secured. Upon an internal shoulder of the point there is a small spiral spring, through which the pencil passes, and which supports two jaws, which are concaved to receive and fit upon the pencil. The outer surfaces of the jaws are made conical in form, and fit into a conical tube which fits into the upper part of the point, where it is secured in place by a bayonet clutch, as shown in Fig. 2. As the pencil is forced downward by the downward movement of the spring jaws, the friction of the pencil upon the conical jaws will tend to move these jaws downward into the larger lower part of the tube, and the pencil will slide down between the conical jaws. As the upper or spring jaws begin to move upward, their tendency is to carry the pencil with them, but the spring forces the conical jaws into the tube, where they are contracted upon the conical inner surface of the pencil with sufficient force to hold it against the pull of the upper spring jaws, so that the pencil will be forced downward a short distance at each downward movement of the jaws. In supplying the holder with a pencil, the point is detached from the case, and the pencil is inserted through the tube and spring jaws from the inner end of the point. The upper end of the pencil is inserted in the lower end of the case, is guided into the space between the jaws, and pushed upward until the point reaches its seat. The pencil is then pushed inward to the proper point, when it is ready for use. When the pencil is not required for use, it can be pushed inward, so that the pencil point will be protected from being accidentally broken. This invention was recently patented by Mr. B. Eybel, 321 East 54th Street, New York city.



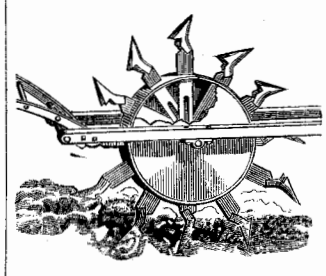
### New Fire Escape.

This fire escape is built on a truck having attached to it a base frame provided with upright rods connected at their upper ends in pairs by cross bars. Bearings attached to the corners of a canvas covered frame slide on the upright rods, and are held up by springs connected with the base and top frames, and with interposed sliding side bars. The top frame is held from rebounding by ratchet bars and spring pressed pawls, which can be withdrawn, to allow the top frame to be raised by the supporting springs, by arms attached to upright rack bars, connected by levers and a rod, whereby both pawls can be withdrawn at the same time. When the apparatus has been drawn to the side of a burning building, the people jump one after another upon the covering of the top frame. As each one alights upon the covering of the frame and forces the frame downward, the several sets of springs are put under tension successively, so that the downward movement of the frame will be stopped before the frame encounters a rigid resistance, and the person will be saved from severe shock. The person using the escape is kept from being thrown off and injured by the rebound of the springs by the ratchet bars and pawls, which detain the frame at its lowest point of descent. This invention has been patented by Mr. Jarvis E. Davis, of Union, Oregon.



### Improved Rotary Plow.

The engraving shows an improved rotary plow, recently patented by Mr. G. A. Betancourt, of 108 Aquacate, Entre Teniente Rey y Muralla, Havana, Cuba. This plow has a rotary drum carrying plowshares, and mounted in a suitable frame guided by handles, and drawn forward by horses in the usual manner. The drum is provided with a series of diametrical slots or mortises, in which are placed as many plow standards, each capable of sliding longitudinally through the drum and carrying at each end a plow. As the plow is drawn forward, the points enter the soil in succession, and remain there until the limit of the end motion of the standards. At he same time they are tipped in the soil very much after the manner of hand spading, loosening and turning the soil in a very effective manner. The plows may be made in various forms and sizes, and they may be used in gangs.



### Stripes of Red Blood in Fishes.

Professor H. N. Mosely, in his Challenger Notes, says: While dredging was going on off the Kermadec Islands, a shark (*Carcharias brachyurus*) which was attended by a pilot fish (*Naucrates sp.*) was caught; it was, as is commonly the case, covered by a small parasitic crustacean, a species of Pandarus. Some specimens of this parasite had, curiously enough, a barnacle (*Lepas*) attached to them as large as themselves.

On the shark being skinned, I noticed that a layer of superficial or skin muscles, extending all over the animal, and only about one-fourth of an inch in thickness, is colored dark red by blood coloring matter (hæmoglobin) as are all the muscles of mammalia. The main internal muscular mass of the shark is pale, almost white. Professor Ray Lankester has described several instances of the restriction of the red coloring matter to certain muscles only, in animals which possess it.*

A closely parallel case is that of the little fish, the "sea horse" (*Hippocampus*), in which the muscles of the dorsal fin only are red.

Mr. Lankester accounts for the presence of the hæmoglobin in the dorsal fin muscles only in this case, by the special activity of the fin in question, but such an explanation fails in the case of the shark, the skin of which is apparently immovable; moreover the structure of the skin precludes the idea of the red matter beneath it having a respiratory function. Mr. Lankester has shown that hæmoglobin is entirely wanting in one fish at least, the white transparent oceanic surface fish Leptocephalus, and I believe that small oceanic flat fish, Pleuronectids, will prove also to be devoid of red blood coloring.

### Nickel Wire in Silver and Gold Lace.

The silver plated copper wire hitherto employed soon rubs off, and the unwelcome disagreeable red color of the copper makes its appearance in spots here and there. MM. Comte and De Bary Kroess have used aluminum alloyed with silver to avoid this difficulty.

We learn from the *Polytechnisches Notizblatt* that Troeltsch and Hanselmann, in their lace factory at Weissenburg, make use of nickel which has been deprived of its brittleness. Fleitmann and Witte, of Iserlohn, made the discovery, not long since, that the addition of a small quantity of other metals would render the nickel so ductile that it could be drawn out into wire of the finest numbers and be scarcely inferior to copper. Wire has been drawn so fine that 18,000 meters only weighed 100 grammes (or twelve miles weighed about 3½ ounces avoirdupois).

Ductile nickel differs from copper, so that the increase of price for increased sizes differs from that of the plated copper wire hitherto in use.

For articles subjected to much wear and the action of the weather this ductile nickel will be very useful. For the lace used on military uniforms the plated copper wire will go out of use entirely, as nickel wire would always keep white and no verdigris ever be formed. Great anticipations are made for it in other directions. too.

### The Hudson River Ice Harvest.

The Hudson River ice crop of the season just closed is rated as one of the largest, if not the largest, ever harvested. It amounted to nearly 3,000,000 tons.

It is said that not so many new houses were built last fall as the previous one; still, those constructed were quite large, and increased the storing capacity 200,000 tons. The ice gathered ranges in thickness from eight to twenty inches, and, owing to the low condition of the river when it froze over, is as clear as crystal. The housing this year cost from 4 to 7 cents less per ton than last year. Notwithstanding the cry of short crop last winter, about 100,000 tons remained in houses unsold at the beginning of the year. Nearly 50,000 tons of this was ice gathered in 1880, which had been held ever since for a good market. But little ice was stacked.

*E. Ray Lankester, "On the Distribution of Hæmoglobin," Proc. Royal Soc., No. 140, 1873.

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## ENGINEERING INVENTIONS.

An improvement in journals and other bearings has been patented by Mr. Ferdinand E. Canda, of New York city. It has for its object the production of an improved anti-friction material for journals and other moving parts of machinery, which consists of the pulverization of any of the metals which amalgamate with mercury. The inventor heats the mass to a sufficient degree (say 280° Fahr.), when the whole forms a plastic mass which he casts into moulds of the shape of the bearing to be produced, adding pressure to give it form and expel the superfluous mercury. It soon hardens, when it is ready for use.

Mr. Levi H. Roberts, of Paris, Ill., has patented an improved journal box. The object of the invention is to provide a practical anti-friction journal or axle box for railroad car and other axles; and it consists principally of journaling two anti-friction wheels or rollers in and between two boxes; these are coupled together and adapted to be placed upon the journal portion of the axle, with the anti-friction wheels or rollers resting upon the axle and supporting the weight of the car. The invention also consists of oil boxes for the journals of the anti-friction wheels, of the means for coupling the front and rear boxes together, and of journal blocks to fit in the front and rear boxes upon the journals of the anti-friction wheels. It is claimed that by this invention the capacity of the motive power is increased, and the danger from boxes becoming heated is obviated.

An improved mining auger has been patented by Mr. William N. Talley, of Hampton, W. Va. The invention consists of an auger and threaded shaft mounted in a screw threaded supporting nut, which nut is made in two parts, so that it may be taken apart and reset for beginning a new bore, and these are held together by a pivoted S-shaped button, which passes into nicks in stud pins designed to receive it. The nut for holding the auger is mounted on uprights with a pointed head piece to be set against the roof of the mine, and jackscrew to rest in a cavity in the floor. The nut is held in position by clamps which fit into recesses prepared for them in the supporting bars. In this way the auger is readily detached from the frame, in order that the auger bore may be cleaned without the frame being taken down from its position.

An improved stock car, in which the animals may be easily and rapidly fed, and in which they may be transported without being subjected to the inclemencies of the weather, has been patented by Messrs. Henry R. Bothwell and James H. Strugnell, of Toronto, Canada. The invention consists in chains attached to the opposite standards of the car, and provided with chains which are attached to adjoining transverse chains for forming supports under the bellies of the animals to prevent them from lying down, but on which they can rest. Combined with manger bars are a series of hooks on the standards and on the walls of the hay boxes, for the purpose of facilitating the adjustment of the mangers to the size of the animals. A diagonal bar is attached to the ceiling of the car and to one of the sides, and a piece of canvas is attached to it, and also to the ceiling and side of the car, which forms a partition at the head end of the stalls. Hay and water boxes are arranged on top of the car, and are provided with proper outlets at the bottom by which the animals are fed and watered.

An improved device for applying the brakes to railroad cars has been patented by Mr. Charles Van Dusen, of New Albany, Ind. The invention consists of a cylindrical reservoir suspended beneath the tender or in any convenient place, divided into two compartments by a horizontal partition, the lower compartment being partially filled with water; steam being introduced into this from the engine by a pipe which is provided with a stop cock, and with a valve for permitting the water to escape when it rises above a certain point in the chamber. The only connection between the upper and lower compartment is by a large pipe, which is provided with a float by means of which the water is prevented from rising above the neck of the pipe and passing into the upper chamber when the pressure is being applied to the water in the lower chamber by the steam from the engine. The air is compressed by the rising of the water in this pipe; a reservoir is suspended near this for a reserve supply, but this is not absolutely necessary. The air is conducted from these reservoirs by means of proper hose and connecting pipes to the braking apparatus on the car, passing into a chamber provided with a piston working vertically and connected with a cam lever arrangement by which means, when the pressure is applied, the toe of the cam is elevated and the friction wheel is brought against the inner surface of the car wheel. This air brake arrangement is very simple in its construction, and is intended to be entirely under the control of the engineer.

## MECHANICAL INVENTIONS.

Mr. Joseph H. Hunter, of Adair, Ill., has patented an improved water elevator. The invention consists of a combination of pawl and ratchet wheels, by which are set in motion angular buckets attached to metallic plates which are hinged one to another, forming an endless chain, and passing over a wheel provided with forked arms, by means of which contrivance the water is elevated and discharged.

Mr. Henry Cutler, of North Wilbraham, Mass., has patented an improved grain drier, whose object is to provide driers of large capacity, in which the temperature can be raised to a high point without any injury by expansion and contraction, to the machine, or the liability of breaking joints, and consequent leaking. This invention is an improvement on a machine for the same purpose patented by Mr. Cutler on September 20, 1881.

Messrs. James Kneen, 2d, of Birmingham, and Wellington M. Reed, of Huntington, Conn., have patented an improved escapement mechanism for watches. This invention relates to the ruby pin tables of watches, with the object to allow adjustment of the tables and hair spring of the balance wheels without removal, as is required when the wheel and table are attached permanently to the pivot shaft. The parts can be readily adjusted in relation to each other on the staff.

An improved hand vise for brooch pins has been patented by Mr. Myer Moss, of Yarmouth, Nova Scotia, Canada. This invention relates to a tool used by jewelers in repairing brooches and similar small articles. The tool is provided with jaws to grip and hold the article to be mended, with a series of graduations for regulating the required length of the joint of the brooch being repaired.

A novel hand truck, the object of which is to provide means for preventing backward movement of hand trucks while the load is being placed upon them, has been patented by Mr. George P. Clark, of Windsor Locks, Conn. The invention consists of a spring-actuated holder or clamp placed upon the shaft or axle of the truck, which is adapted to be pressed down by the foot of the user to engage with the floor while the box, barrel, or other load is being placed upon the truck.

A novel circular sawing machine has been patented by Mr. Christian J. Steinbach, of St. Louis, Mo. The invention relates to cut-off sawing machines in which the saws are made to move while cutting, instead of the wood. In this machine a single saw slide and belt are made to work two saws instead of one. The invention also consists of an improved arrangement of the gear for reciprocating the saw slide, an automatic apparatus for discharging the pieces sawed off, and an adjustable gauge stop.

Mr. Aaron Emerick, of Johnsburg, Pa., has patented an improved shingle sawing machine. This invention consists of a shingle sawing machine having a carriage provided with an automatically operating gauge for the bolt. This gauge is so constructed that by a slight movement of the bolt the butts of the shingle may be formed alternately at opposite ends of the bolt. The arrangement of the mechanism is such as to allow the shingle to drop with ease as soon as severed from the bolt.

An improved draughting instrument has been patented by Mr. Henry C. Root, of San Francisco, Cal. This invention consists in an instrument for determining the lines and bevels of circular stair rails, for determining the lines and bevels for jack rafters in hipped roofs, and other purposes of a similar nature, the object being to determine the angle subtended by the tangents and the pitches or bevels which are in the same plane. For architects and builders this instrument, which is denominated a tangentograph, would seem to be highly useful.

A new washing machine, an improvement upon that class of washing machines having a slotted or perforated revolving cylinder for containing the clothes, which rotates in a box containing the water, has been patented by Mr. William Bruen Smith, of Clayton, Ill. The chief feature of the improvement is the clothes rubber and presser suspended so as to swing freely within the cylinder. The revolving movement causes the clothes to rotate in contact with both the rubber and periphery of the cylinder, and the water being kept in motion thus washes and rinses the clothes in the shortest possible time.

An improved boiler and furnace, the object of which is to economize space and fuel in the construction and use of boilers and furnaces, has been patented by Mr. James H. Mackintosh, of Paterson, N. J. The invention consists in a boiler and furnace constructed with three concentric annular water chambers connected by pipes, divided into compartments by partitions, and having enlarged lower ends. The water chambers are supported upon a base, are inclosed with a casing, and are provided with a central coal reservoir and two fire pots. The boiler is so constructed that the water is caused to circulate in thin sheets, and, exposed to the heating surface on both sides, insures rapidity in the heating of the water.

A novel fire escape has been patented by Mr. Charles Roberts, of Montgomery City, Mo. The invention consists in a standard, on which is mounted a platform and turn table frame, to which ladders are attached, which platform carries a windlass for raising the ladders. The ladders can be raised by means of the windlass, and are held in position by ropes. The platform and the frame can be turned on the standard, the ladders being balanced by the overhanging part of the frame. After the ladders have been erected they can be swung into any desired position by turning the platform. Ladders of any desired height can thus be raised very rapidly, and can be moved from one place to another very easily.

A pump of improved construction has been patented by Mr. Jesse A. Heydrick, of Barnhart's Mills, Pa. The invention consists in a rotary vertical cylinder attached to the lower end of a rotary stand pipe, which cylinder contains a reciprocating piston provided with downwardly projecting shanks or prongs resting on spiral tracks, whereby the piston will be reciprocated and water raised when the pump tube and the cylinder are rotated. The piston is provided with a perforated pipe within a larger perforated pipe connected with the spiral tracks. The invention further consists in an inverted cylindrical cup attached to the upper end of the stand pipe, into which cup is a tubular projection which forms part of a vessel surrounding the inverted cup.

An improved spindle and bearing therefor have been patented by Messrs. George B. McCracken and Samuel Hamer, of Willimantic Conn. The invention relates to that class of spindles in which the bobbin is held steady at the top by a short spindle and turned by a whirl placed on a central stud, whereby the bobbin is made to run easy, steady, and true, the bearings properly oiled without retarding the motion of the spindle or soiling the bobbin. The oil may be used over and over again. The spindle may be easily taken apart for cleaning and the wearing parts replaced with ease and small expense. The bobbin being held at the top and bottom only, prevents friction, and enables the spindle to run very lightly and steadily.

A machine for grading coffee according to the size of the berries, and at the same time to free the coffee from sticks, stones, sand, and other impurities mixed with it, has been patented by Mr. Elam Rakestraw, of Cambridgeport, Mass. The invention consists in a reciprocating screen shoe combined with a box with a curved surface, upon which the coffee drops from the screen shoe, and in passing is exposed to a powerful current of air, which blows the light coffee over swinging wings into suitable receptacles. The heavy coffee and stones drop upon the wings and slide down into a chute, and from the chute into an elevator, which raises them to a hopper, so that they pass through the screen shoe a second time, and perfect the separation.

A new apparatus for making salt, the object of which is to provide an improved concentration of brine, has been patented by Mr. Clemens von Bechtolsheim, of Munich, Germany. The invention consists in the arrangement with a brine boiler of a device for receiving brine from the boiler, and two evaporating pans. One of the pans is connected with the boiler and a pumping engine in such a manner that the steam from the pan, which is heated by direct flames, can be used to heat the brine in the boiler and to work the pumping engine. From the boiler the brine passes into the dome, and is then pumped into the two pans. The steam from the dome is utilized to heat one of the pans. The main object of the invention is to economize fuel.

An ingenious post hole boring machine has been patented by Messrs. William Graham and William H. Staley, of London, Ohio. The machine is designed for boring holes, say six, seven, or eight feet apart, according to the length of the boards to be used; but it may be constructed to be adjusted for any distances within practical limits. The augers are secured to a frame one at each end, with the driving mechanism which consists of an ordinary horse power arrangement placed in the center of the frame midway between the two augers. The master driving wheel meshes into the gearing attached to the two augers, and when the large wheel is propelled by horses attached to the sweep, both of the augers are operated at the same time.

An improved foot power mechanism applicable to bicycles, sewing machines, lathes, and similar machines, in which foot power is employed, has been patented by Mr. Anson F. Fisher, of Chico, Cal. The invention consists in a horizontally swinging treadle connected with a pawl carrier, which in turn is connected with a ratchet wheel, the latter being located at the axle of the working wheel and joined to it, so that when the treadle is pushed forward, the pawl carrier is likewise pushed forward to the ratchet wheel, which sets the whole mechanism in motion. The treadle is brought back in place by a spiral spring, one end of which is attached to the propelling shaft, and the other end to the forked standard of the bicycle, and thus a rotary motion is kept up.

## AGRICULTURAL INVENTIONS.

An improved cultivator, the object of which is to remove the vines from between the rows of sweet potatoes, and lay them on the ridges of the rows without injury to the vines, and at the same time cultivate the spaces between the potato rows, has been patented by Mr. Bernhart Kemper, of Muscatine, Ia.

An improved protector for hay and grain stacks, to prevent the top from being blown away and protect them from rain, has been patented by Mr. George G. Matthews, of Wichita, Kan. The invention consists in a protector for hay and grain stacks constructed with a board having longitudinal drain grooves along its upper surface. A narrow top board is secured to it for clamping the overlapped ends of the thatching material. To the lower side of the base board are hinged tapered stakes with teeth for securing the protector firmly to the stack.

An improved cultivator has been patented by Mr. William H. Luce, of Prairie Centre, Ill. The frame of the machine consists of a cross beam mounted on wheels, and supported by side braces, from the rear extremities of which depend the plowshares, so adjusted that their proximity one to the other is regulated by a very simple mechanism. The depth which the plows are to work is determined by a curved connecting bar which is attached to the pole or tongue of the vehicle, and passing through a slotted post is held in any desired position. A lever connected to the after-part of the machine is operated by the driver, by which he is enabled to alter the pitch of the machine.

An improved corn planter, designed to facilitate the planting of corn and also to promote convenience in guiding the machine parallel with the row last planted, has been patented by Mr. John R. Owen, of Pulaski, Tenn. Attached to the axle of the wheel at the middle and rotatable with it, is placed a cylindrical box with two chambers cut in it, of a size suitable to hold enough corn for one hill, these chambers being placed immediately opposite one another, and thus emptying their contents at every half revolution of the wheel. Above the cylinder is placed the supply box. The seed is planted and covered, and the mound formed by plows located at the rear of the vehicle, and a horizontal bar to assist the eye in the guiding of the machine is provided, so that every row is equally separated from every other row, and the whole field uniformly planted.

## MISCELLANEOUS INVENTIONS.

A novel sand band adapted to be applied to thimble skein axles has been patented by Mr. Delos M. White, of Hudson, Wis. The invention consists of a collar divided into equal or nearly equal parts, and of a dust chamber and of flanges and belts so related as to keep the axle almost completely clean from dust and sand.

An improvement in crimping machines, where the crimping and stretching is done at the same time, has been patented by Mr. Dominick A. McDonald, of Rockland, Me. The invention consists in devices to lessen the number of times of handling the leather or substance to be crimped, and to stretch the material when desired.

A new composition for removing scale or calcareous deposits in boilers has been patented by Messrs. Charles R. Bacon and Frank Queen, of St. James, Minn. It consists of aqua calcis, or lime water, and pure sweet oil, of equal proportions. This compound mixes readily with the water in the boiler, and attacks all lime deposits alike and softens them. This compound does not remove the deposits, but softens them to such an extent that they can be washed off readily by means of a stream of water.


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The Portable Electric Light Co. are having large sales for their Portable Electric Lighter. See adv.

Cope & Maxwell M'f'g Co.'s Pump adv., page 77.

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Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 78.

The Sweetland Chuck. See illus. adv., p. 78.

Knives for Woodworking Machinery. Bookbinders, and Paper Mills. Taylor, Stiles & Co., Riegelsville, N. J.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) F. S. D. asks: How does the winding of the magnets in a magneto call bell differ from that in ordinary electro magnets? I wish to make one so that the magnets draw alternately. A The winding is the same in both cases.

(2) A. W. W. asks whether sulphurous acid can be administered to any one with bronchial catarrh. A. Sulphurous acid can be made and taken anywhere. As it is somewhat dangerous, we should recommend its use only under a physician's guidance.

(3) H. E. F. asks for a good receipt for making "treer's blacking," that which is most generally used by "treer's" in the boot and shoe manufactories. A. Dissolve gum tragacanth in water, then add a little ink to make it black, and finally add a small quantity of neatsfoot oil. It must be quite thin, or else, if thick, it is liable to cake.

(4) C. A. B. asks: We have a melting kettle of cast iron, holding about five tons of metal (lead), which has a slight crack in it, through which the molten lead finds its way. Can this be repaired, and how? A. If the crack in the melting kettle is where the fire touches it, you cannot mend it by patching with rivets, as it will not be reliable. If the crack is very small, it might be drilled out, tapped with a taper pipe thread, and plugged. If the crack is directly over the fire, this will not save the kettle. A foundryman could "burn" the crack out, if you can take out the kettle and send it to him. Otherwise you will have to procure a new kettle, which is probably advisable.

(5) T. S. C. writes: I want an anti-friction metallic piston for packing a three inch steam or water cylinder. I am using lead for the rings. Can I mix it with any other metals so as to make it harder and be elastic too? If so, please state the component parts. Can a small cylinder, as described above, be made tight with exclusive metallic ring packing? If so, please state how. A There is no way of making it perfectly tight; if the cylinder is for cold water, use a cup leather packing; for steam, you can add tin to your lead and get a harder packing. Try good Babbitt metal.

(6) G. B. M. asks why hot air can be seen coming up from a hot stove, while we cannot see the wind blow. A. The refractive power of hot air differs from that of cold air, and when in circulation, mixed with cold air, as in a column rising from a hot stove, it produces a vibratory effect upon objects seen through it. You also see particles of dust floating in the upward current, but you do not see the air itself. The circulation of air is indicated by the floating dust when a beam of sunshine enters a dark room.

(7) E. M. writes: 1. I have an engine, 4 inches bore and 6 inches stroke; I also have a boat model, built 21 feet long by 5 feet beam, 2 feet in depth, draught of water, 18 inches, including 6 inches keel; can also get 14-inch propeller wheel. Will this be large enough, or too large? A. Your wheel should be 18 inches diameter. 2. Will this run her direct-acting frame engine to wheel? A. Yes. 3. What speed upstream will she make, current three miles an hour? A. Speed depends on power applied; probably not more than 3½ to 4½ miles. 4. How many revolutions a minute will the engine be required to make. A. 360 to 400 revolutions per minute. 5 What sized boiler will it take for engine to make plenty of steam? A. 80 to 90 square feet heating surface.

(8) A. J. H. asks: 1. How much power will a 12 foot windmill generate in an ordinary wind? A. Average about 1½ horse power? 2. Will the dynamo-electric maching described in SUPPLEMENT, No. 161, produce twice as much electricity if it is built twice as large? A. Yes. 3. Will you please mention the name of a good firm of which to procure cotton and silk covered copper wire. A. See our advertising columns.

(9) A. P. C. asks how to polish the blades of knives and scissors after sharpening. I have a small lathe, if that would be of any service. A. For a small lathe a buff made of two or three disks of thick sole leather, 3 inches or 4 inches diameter, placed upon a spindle of wood or iron, pressed together with nuts and washers, or glued if on wooden spindle. Turn off true, and use the finest flour emery and a little oil to hold the emery. If a higher polish is required, use tripoli or rotten stone or crocus, as you may find best by trial.

[OFFICIAL.]

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**January 30, 1883,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

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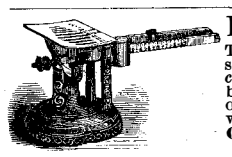

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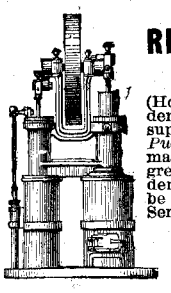

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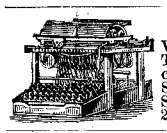

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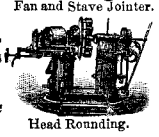

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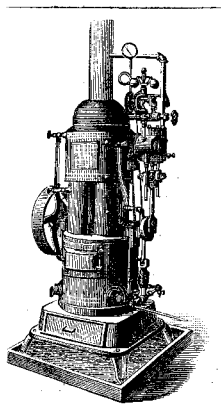

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**Electric Exhibition,**
**VIENNA, 1883.**
The Commission of the International Electric Exhibition in Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors.
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This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well remembered Universal Exhibition of 1873.
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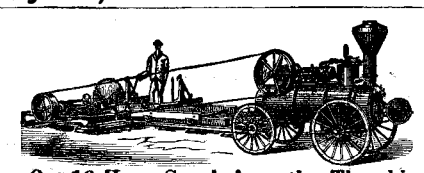

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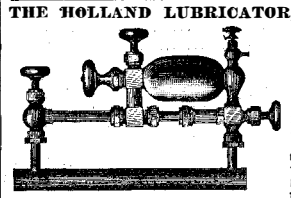

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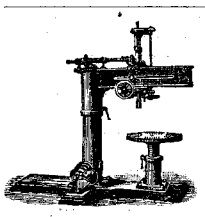

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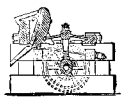

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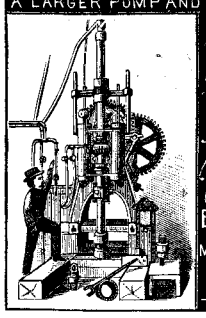

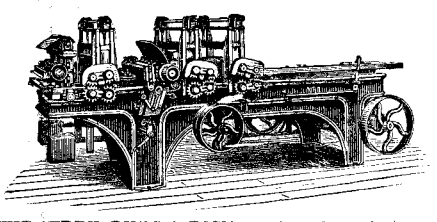

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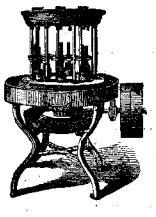

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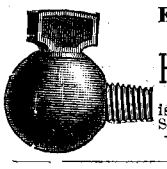

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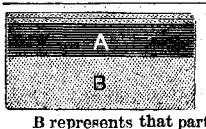

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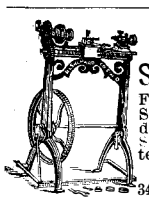

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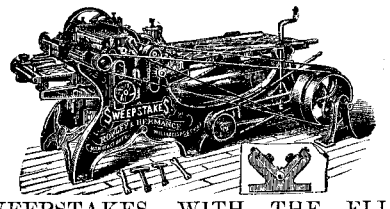

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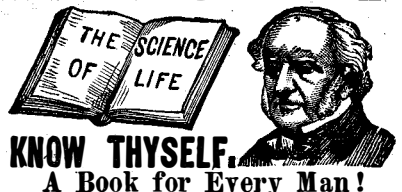


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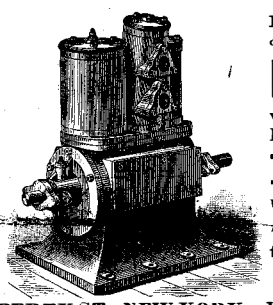

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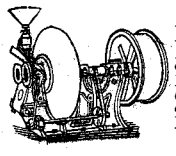

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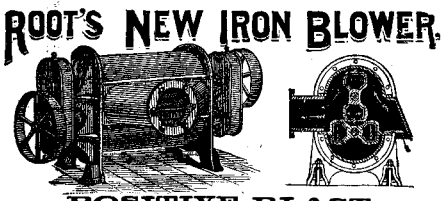

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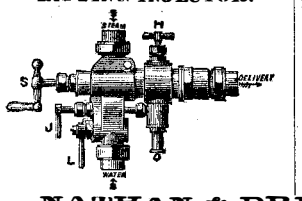

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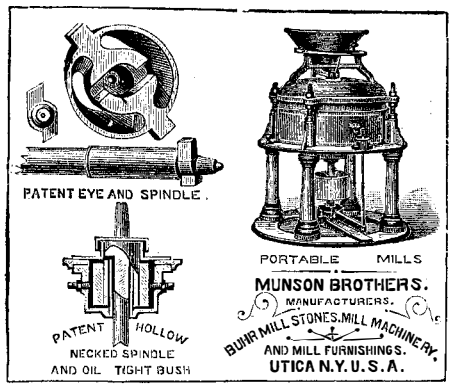


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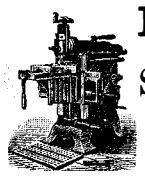

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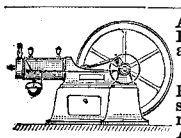

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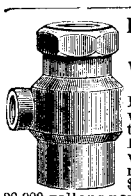

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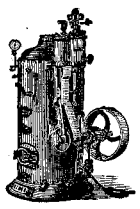

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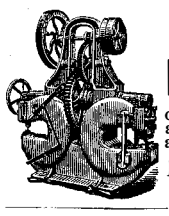

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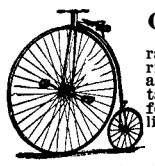

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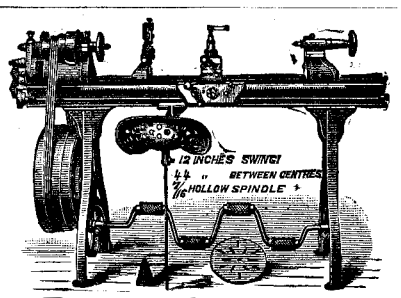


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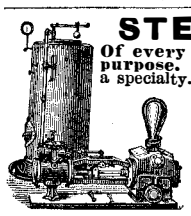

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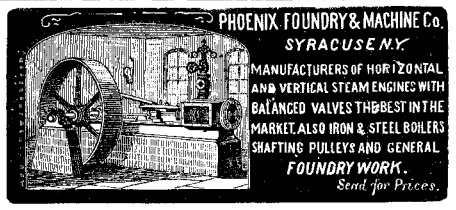
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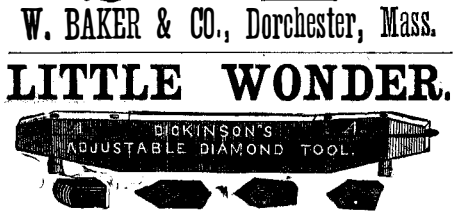


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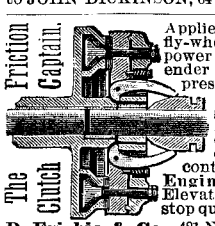


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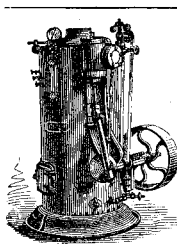

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